The Chemical Age

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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Restriction of Dye Imports

WE are interested to see that the policy we have ventured to suggest as the most practical and politically effective for users and traders in dyestuffs towards the prospective Government scheme for licensing imports is also the policy of the Calico Printers' Association as outlined by the chairman in a notable statement to the annual meeting last week. Two points should be clearly borne in mind at the outset. First of all, the Government are committed to the principle of establishing a home dye industry. The basis of this policy is "national safety," a term which, as the nation has already discovered, may serve to cover a multitude of sins. Secondly, the Government have decided to protect our nascent dye industry by the prohibition of imports, subject to a system of licensing. There were four courses open to them—firstly, free imports, which the Government found to be inadmissible; secondly, protection by tariff, which perhaps would have proved even more difficult; thirdly, subsidy, which the Government adopted up to a certain point, but have apparently decided not to pursue further; and fourthly, the prohibition of the import of dyes except under license.

Now, whichever of these policies the Government had decided to adopt, they were sure to arouse criticism and opposition. The licensing system will be exposed to attack by the remnant of the old free trade party, almost certainly by the Labour party on general grounds, and by those who use and trade in dyestuffs, and who are concerned both for their own interests and for national trade. Nevertheless, unless the Government should receive a clean knock-out blow, the probability is that their measure will pass. They will be able to rely on the "national safety" argument, which is, of course, a powerful one, and quite legitimate if kept within limits; they will argue that of all the possible courses the one adopted promises the best result; they will appeal for the patriotic support of all who wish to see this country independent of Germany and all other possible enemies. In such circumstances, the balance of chances is decidedly in favour of the Government. Unless, therefore, the opponents of the policy have no further line of defence than that of direct opposition to the scheme, they may find themselves in a bad way.

It is at this point that the Calico Printers' policy comes in so effectively. They dislike the system of licensing; they may be trusted to open fire on it in its passage through Parliament. But recognising that the licensing system may have to be accepted, like practical men they are prepared with definite suggestions and safeguards for limiting its bad effect on British trade to the smallest dimensions. These suggestions are so clear and practical that they might well become the basis of co-operative action by all who have the same end in view. United and concentrated on definite points, the opposition may save the situation; if on the contrary it is dispersed over different lines of policy it may achieve but little tangible result. The Calico Printers have set out to discover safeguards whereby the mischief inherent in any licensing system may be limited as far as possible. They lay down four essential points:—

1. The licensing committee must consist of practical men with technical knowledge.
2. The colour-consuming trades must be consulted as to the licensing machinery to be employed.
3. The onus of proof as to the suitability of a British colour to meet the needs of the trade must lie on the colour-maker and not on the colour-consumer.
4. The operation of the licensing system must be limited to a definite period.

Here all concerned in the question from the consumers' and the traders' point of view have the nucleus of a sound and practical policy. The sooner all join forces, the better will be their prospect of success.

Apart from his references to the prospective Imports Restriction Bill, the chairman made some statements as to the general position which must set all interested in the dye industry deeply pondering. We were quite prepared to learn our indebtedness to Switzerland, but it is a little alarming to be told that but for the dyes received also from America, and, since the date of the Sankey judgment, from Germany, the British colour-consuming trades could not have preserved a reasonably full volume of production. Admittedly, progress has been made, but according to the Calico Printers' estimate there is little prospect of an early or complete dependence on a home production adequate in quantity, variety, and excellence. The whole matter is summed up in one pregnant sentence: "The advances that will be made by other countries and by Germany in particular in research and discovery, widening the ranges of colour and expanding the possibilities of its application, are so certain that no channel must be closed to the British colour-consumer which would furnish him with the colours necessary to produce goods of the excellence possible to his foreign competitor." The problem now is how to build up a home dye industry without breaking down British trade in the process, and the Government must bear the latter point in mind equally with the former.

Utilisation of Coal Slack

INNUMERABLE attempts have been made to treat and turn to profitable account the low-grade coal slacks which, owing to the impurities they contain, are unsuitable for conversion into metallurgical coke. The latest suggestion for preventing waste of this description is brought forward by Messrs. A. E. Beet and A. E. Findlay whose process is based on the fact that the portion of the coal which floats in a solution of 1·3 specific gravity is a more or less pure material containing only 0·5 to 2·5 per cent. of ash and 0·7 to 1·8 per cent. of sulphur, whereas that which floats in a solution of 1·4 specific gravity contains quantities, usually large, of coal with an ash content of 7 to 10 per cent. in addition to the whole of the pure material. Experiments with standard varieties of coal have led to the conclusion that any coking slack can be separated into several fractions. The first fraction, representing from 55 to 76 per cent. of the whole, is almost free from sulphur and ash, and on carbonisation would yield a metallurgical coke containing only 3 per cent. of ash and well under 1 per cent. of sulphur. Secondly, a homogeneous coaly substance is obtained which is admirably suited for low temperature distillation and the production of a smokeless domestic fuel. This fraction varies from 17 to 34 per cent. of the weight of the whole sample, and yields, it is claimed, from 20 to 50 gallons of mineral oils per ton, also 11 to 15 lb. of sulphate of ammonia. The third fraction (representing 20 to 40 per cent. by weight of the original material) consists of about half and half of coal and dirt, and yields a low grade gas as a main product as well as oils and sulphate, the residue remaining being ashes only. The selective separation of slack in this way would certainly appear to offer possibilities, particularly as it is stated that the yield of all products from the first fraction would be rather greater than the total obtained from present practice, while if, as is claimed, a comparatively cheap smokeless fuel could be produced from the second fraction, then it should be possible to dissuade the average domestic consumer from burning raw coal. Up to the present the fact that smokeless fuels have invariably cost more than raw coal has been a great deterrent to their general use.

A New Process of Gas Adsorption

WE have just received from Baltimore an interesting account, written by Mr. E. B. Miller, of a new process for the adsorption of gases which has been perfected on a semi-technical scale, and which only awaits certain engineering modifications before being turned to general industrial use. The adsorption of gases and vapours by certain porous bodies, such as charcoal and kieselguhr, has long been a matter of common knowledge, but much of the uncertainty and inaccuracy of the early work was due to the difficulty experienced in preparing adsorptive mediums of constant properties. It was eventually found that adsorbents could be prepared from certain colloidal solutions, and that such substances possessed the power of adsorption equal, if not superior, to that exhibited by charcoal. The new material of which Mr. Miller writes is silica gel which is prepared from a colloidal solution of silicic acid. It is readily and cheaply made from silicate of soda and either hydrochloric or sulphuric acid, and is particularly inert and, therefore, stable in air even at high temperatures. It is the physical properties of an adsorbent which chiefly determine its activity, and it will be appreciated that all substances of the kind must be porous, with a large internal volume composed of exceedingly fine pores. Silica gel appears to satisfy all the necessary requirements, and it has yielded some remarkable results when tried experimentally with a number of gases and vapours. For example, sulphur dioxide, at a concentration of 0·5 per cent. in the mixture of that gas and air, and with a time contact of 0·8 second, was adsorbed to the extent of 100 per cent., and in none of the experiments was the saturation of the silica gel less than 57 per cent., at which stage it became partially inactive owing to the limit of saturation having been reached. To consider one of the industrial applications of the material one might take the case of a gas which, say, contains 4 per cent. of sulphur dioxide by volume. It is desired to concentrate this up to 8 per cent. for use in the chamber process of sulphuric acid manufacture. The obvious procedure to follow in using the gel is to effect adsorption at as low a temperature as possible, but in the example in question it may be assumed that the adsorption temperature is 30°C. At this temperature the gel will take up 6 per cent. of its own weight of sulphur dioxide. Once it is saturated the temperature is raised to 100°C., and the sulphur dioxide is swept out by means of an air stream, the quantity of air being so regulated that the desired concentration of the issuing mixture is given. Much higher concentrations can, of course, be obtained. For instance, as lean a mixture as 1 per cent. may be brought up to 8 per cent. in a single stage. If a very high percentage gas is required, as, for example, for the manufacture of liquid sulphur dioxide, air would not be used for expulsion

purposes, but the adsorbed gases would be liberated at 100°C., or over, by evacuation. By proper regulation of temperature, pressure, &c., it is possible to obtain any desired concentration up to 100 per cent.

In America it is thought that the new adsorptive material may prove of inestimable value in a variety of industrial purposes, in which considerable losses of solvents such as ether, acetone, alcohol, &c., occur; while, as the so-called permanent gas may be adsorbed at low temperatures, it is believed that the material will provide a means for effecting the selective separation of mixed gases. Moreover, such problems as the fractionation of liquid air into oxygen and nitrogen may be simplified. Of particular interest are the experiments which have been carried out with the gel discharged into the gas atmosphere in pulverised form by means of apparatus similar to that used in pulverised coal installations. After being fed into the gas stream the pulverised dust is brought down by a dust collector, thus continuous operation is arranged for.

Chemical Industry in India

AMONG the many fields offered by the Empire for the application of chemistry to the development of natural resources, India is one of the most promising. The imports of chemical and allied products into the country amount to a considerable sum, but are insignificant when compared with the opportunities for development. In an article on "The Future of Chemical and Allied Industries in India," Mr. L. A. Admani points out, in dealing with alkalis and acids, that every ounce of alkali used in India is imported; it is therefore almost impossible to start a native industry for the manufacture of goods in whose production alkalis and acids largely enter. The Leblanc process is regarded as the most suitable to Indian conditions, but it requires sulphur or iron pyrites in considerable quantity, and India possesses no extensive deposits of either. It has, however, unlimited supplies of gypsum, which is said to yield about 18 per cent. of sulphur. Dyes are regarded as too complicated a business for India to contemplate at present. Several glass factories have been started of late years, but the results are not quite up to expectations, owing probably to the high cost of alkalis. Soap making is regarded with favour, for India grows enormous quantities of oil seed, and it has been estimated that some million pounds worth of such seed is annually wasted owing to lack of means of proper treatment and utilisation.

Outside the strictly chemical industries, there are several opportunities for enterprise. Bauxite, for example, occurs in great quantities in the Central Provinces, and the Indian quality is said to be excellent for the production of aluminium. The present demand for aluminium in India is about 2,500 tons, all imported; but it is estimated that within five years at least 12,000 tons will be needed, and with cheap hydro-electric power India's entire need could be met. The cement industry has made good progress in India of late; native production already equals about two-fifths of the requirements, and it is suggested that within a few years India may be independent of foreign supplies. As a field, however, for the application of chemistry, agriculture offers the largest possibilities. Much of the cultivated land in India has almost reached the maximum state of impoverishment. With a scientific understanding of Indian soils and the application of the manures and good cultivation needed for the desired crops, agriculture in India might be revolutionised. Of course, all the developments touched upon are yet in a very early stage, but it is satisfactory to find the friends of Indian progress recognising the important part which chemical industry and chemical products must play in the realisation of these ambitions.

Canadian Paints and Varnishes

THE official report published this week on the paint and varnish industry of Canada shows that the industry is now firmly established in the Dominion, and is making steady progress. Forty-five establishments are engaged in the trade, and the total capital the industry at present represents exceeds 15 million dollars. The value of the materials used amounts to over nine million dollars, the products made are estimated at over 17 million dollars, the exports of paints, varnishes, and materials are valued at 2,112,113 dollars, and the corresponding imports at 6,309,836. It will thus be seen that the industry has already reached considerable dimensions. The figures given in the tables indicate the extensive use now made of zinc oxide and lithopone as paint pigments. Basic carbonate white lead is still used in larger quantities than any other one pigment, but recent advances in the study of paint pigments have shown that zinc oxides and lithopone are very desirable pigments for certain uses. During the year under review (1918) a study of white paints was carried out in the laboratories of the Department of Trade and Commerce. As a result it was found that 73 different brands were being offered for sale on the Canadian market, and that there was a great variety in the formulæ used. The pigments used included basic carbonate white lead, basic sulphate white lead, leaded zinc, zinc oxide, and lithopone, while barytes, blanc fixe, satin white, whiting, asbestine, and silica were often present as fillers, sometimes to quite a considerable extent.

Readers interested in this subject may be informed that the report from which our abstracts are made this week is available for free distribution and applications should be addressed to the Dominion Bureau of Statistics, Ottawa.

The Calendar

Oct.		
1	Society of Chemical Industry (Manchester Section): "The Structure of the Molecule in Crystalline Solids," by Professor W. L. Bragg. 7 p.m.	Grand Hotel, Manchester.
1	The Textile Institute: Presidential Address by Sir Herbert Dixon, papers by Professor H. M. Lefroy, and O. S. Hall.	Royal Society of Arts, London.
5	The Sheffield Association of Metallurgists and Metallurgical Chemists: "Steels Used in Railway Work," by Sir Henry Fowler. 7.30 p.m.	Assembly Room, Royal Victoria Hotel, Sheffield.
18	Physical Society of London and Faraday Society (Joint Meeting): "The Physics and Chemistry of Colloids."	London.

Scientific and Industrial Research

Record of Department's Five Years' Work

The report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1919-20 was issued this week (H.M. Stationery Office, Cmd. 905, 1s. net, pp. 120.) It contains, in addition to notes on the work of the past year, a general review of the Department's work during the five years of its existence. We give below extracts from the report relating to the chemical and metallurgical industries.

FIVE years having passed since the inception of the scheme for the organised encouragement by the State of scientific and industrial research, the Advisory Council, of which Sir William McCormick is administrative chairman, has embodied in its report for the year ended July 30 a review of the work which has been done by them during the whole of this period. The programme of the Department falls under four main heads :—

(*a*) The encouragement of the individual research worker, particularly in pure science ;

(*b*) The organisation of national industries into co-operative research associations ;

(*c*) The direction and co-ordination of research for national purposes ; and

(*d*) The aiding of suitable researches undertaken by scientific and professional societies.

It is again emphasised, as in previous reports, that industrial research organisations are essentially man-consuming as distinguished from man-producing agencies, and that the only organised training grounds for the research worker are the universities. Attention is directed to the fact that these institutions are overcrowded with students, while their research laboratories are being used for the instruction of undergraduates, and the demand for teachers exceeds the supply. Although it is not the function of the Department to make grants to universities, it makes grants to suitable research workers and students, whether they are in universities or elsewhere. Since the establishment of the Department, 136 maintenance grants have been made to students and 89 to independent workers ; 49 grants have been made to provide professors with competent research assistants, and 87 to give them laboratory or clerical assistance ; during the same period 49 equipment grants have been made.

The development of assistance of this kind during the five years under review is indicated by the increase in the expenditure upon it. During the academic year 1916-17 this amounted to £3,207 ; during the present year it is estimated at £26,700, and it is expected that during the coming year it will reach £45,000. The great majority of the grants have been made for work in the fundamental sciences, and in these cases no conditions are attached either as to the line of work to be pursued or as to the use to be made of the results. In making grants to individuals the Advisory Council are guided not so much by the theme as by the evidence before them of the scientific capacity of the worker. The Council quote with agreement the view of Mr. Balfour that, while the State can aid research, it would only destroy research if it attempted to control it ; at the same time, they share the hope of Mr. Balfour that it does not follow that it is quite impossible to combine with the independence of the worker some better reward for the work he is doing.

Collective Research by Industrial Firms

Experience has shown that the plan of organising associations of industrial firms for the co-operative scientific investigation of their problems is sound, the present position being that eighteen research associations have been established, while five others have been approved by the Department, and will shortly receive licenses from the Board of Trade. The ten research associations actually at work have raised from their 2,300 members an aggregate income of nearly £40,000 in their first year of existence and it is anticipated that in succeeding years, as their work develops, they will raise still larger sums. Out of the million fund granted by Parliament for research associations, £63,800 has already been expended, and it is estimated that the Department is committed to a total expenditure of nearly £450,000 on account of the established research associations and to a further expenditure of at least £120,000 on account of those approved but not yet licensed. Negotiations are now proceeding for the establishment of other research associations, and the total commitments out of the million fund are expected shortly to reach £800,000.

In discussing the attitude of industries to research, the Council refer to the possibility that results of greater value to industry might have been obtained if the million fund had been spent upon research at the National Physical Laboratory, and other research laboratories, rather than in making subventions to associations that have to buy staffs, equipment, and experience at a time when all three are scarce and dear. They point out, however, that it is only after industries have done research for themselves that they can appreciate either its difficulties or its value, and, further, that if the money had been spent on research directed by the Government itself its effect upon manufacturers would have been destructive of their self-reliance. As it is, over 2,500 firms have already guaranteed a minimum aggregate income for research of £38,400 a year for five years, and have shown already that they will considerably exceed their minimum guaranteed expenditure.

A considerable part of the introductory review of the early history of the Department is devoted to a description of the organisation of national research on problems which are of such wide application that no single industry can grapple with them effectively. The first special organisation established for dealing nationally with a problem of this kind was the Fuel Research Board, which was appointed under the direction of Sir George Beilby, F.R.S., in 1917. Fuel, the Advisory Committee say, was the first of the basic problems which were of such wide application that no single industry, however intelligent or highly organised, could hope to grapple with them effectively.

Research Schemes Saved from Abandonment

At the outset of their work the Advisory Council were able to prevent a number of important researches undertaken by scientific and professional societies from being abandoned through lack of funds. The total grants made to organisations of this kind in respect of sixty-nine researches during the five years under review amounted to £68,816. Amongst grants to scientific societies are those to the Silk Association for the researches on the degumming of silk ; to the Institution of Chemistry for their work on laboratory and optical glass ; and to the Royal Society for Sir William Pope's researches on colour sensitiser dyes. Valuable work has been done for the Institution of Metals by Dr. Bengough and his colleagues on the corrosion of condenser tubes. Grants have also been made to three educational institutions for work of urgent industrial importance, to the Stoke-on-Trent Central School of Science and Technology, for researches on hard porcelain, to Sheffield University for work on glass technology, and to the Imperial College of Science and Technology for researches in technical optics.

We give below extracts from the report relating to the Department's work in connection with particular industries :—

Dyers and Colourists

The Committee's report for the year 1915-16 stated that the Society of Dyers and Colourists was engaged in working out a scheme that would form a natural connecting link between the manufacturer, who had problems that needed solution, and the university or technical college, which might be able to solve them. That scheme was completed in October, 1916, and under it grants have been made to the Society in aid of researches connected with the problems of the dyeing trade. The work undertaken includes the dyeing of basic colours on cotton ; sulphide dyes ; French and American resins ; the spectroscopic investigation of cellulose ; tendering of bleached vegetable yarns ; sulphonation of fixed oils ; elimination of nitrogen from vegetable fibres ; production and properties of nitro-oils ; and black dyeing on Tussar silk.

The spectroscopic investigation of cellulose will, it is hoped, throw light on the modifications occurring in the cellulose molecule during manufacturing processes. The examination of the cause of tendering of bleached vegetable yarns relates to yarns and fabrics which have been given a half-bleach to

produce a cream colour. It is found that the deterioration during stoving and storing is due to incomplete removal of mineral acids, there being no evidence that chloramines play any part. The deterioration may be avoided by "creaming" with sodium hypochlorite, when the use of acid is unnecessary. A further cause of deterioration is "yellowing" during storage of steaming; this is attributed to waxes which are only partially removed and slightly altered during bleaching. The difficulty is overcome by efficient scouring.

The work upon the sulphonation of fixed oils has led to the general conclusions that the oils most readily sulphonated are those containing olein and oleic acid, the extent of sulphonation, indeed, depending on the percentage of the two latter materials. During sulphonation, unstable additional products or polymers are probably formed, although to some extent hydrolysis and liberation of glycerol occur. The action of nitric acid upon saponifiable oils was investigated for the purpose of obtaining information bearing upon the mechanism of nitration, the constitution of the products from various oils and the conditions under which the maximum percentage of nitrogen can be introduced. The Indian Government met the cost of the research which had for its object the investigation of the difficulties attending the black dyeing of Tussar silk; the results here obtained are so far inconclusive. For the current calendar year the Committee have recommended a further grant to the Society for the continuance of such of these investigations still in actual progress. Now that research associations for the cotton, woollen and worsted, linen and silk industries have been established, however, it is not proposed to recommend any further continuance of the grants to the Society, since investigations relating to the use of dyes for textiles fall within the province of these bodies.

Silk Association

Pending the formation of a research association for the silk industry, grants to the Silk Association have been continued. The chief problem investigated was the action on raw silk of various agents which could be employed for the removal of the gum, with a view to finding an agent economical in practice and at the same time yielding a product of high tenacity and satisfactory lustre. The investigations, carried out at the Imperial College of Science and Technology, under the direction of Dr. S. B. Schryver, are not yet complete; but during the past year have reached a stage at which the results could usefull be summarised.

Glass Technology

The grants made by the Department to the Institute of Glass Technology at the University of Sheffield are temporary in character and will be discontinued as soon as the Glass Research Association has entered upon the full programme of its activities. For the most part the work recently undertaken at the Institute has been directed to the correlation of the physical and chemical properties of different glasses with their chemical composition. Thus, investigations have been made of the thermal expansion, durability, elasticity and density of a number of lime-soda glasses of known composition; and quite recently this work has been extended to magnesia containing glasses. The University of Sheffield, recognising the value of the investigations carried out under Dr. Turner, have appointed him to a full professorship.

Tin and Tungsten

The investigations of various proposed methods of treatment to which reference was made in last year's report have been completed, but it has not been found practicable to apply any of these methods to industry, and the researches have accordingly either been abandoned or suspended for the present. Further research in flotation has not been made during the year because experimental work on an extensive scale is being carried out in Cornwall by East Pool & Agar, Ltd., and also by Minerals Separation, Ltd. The results of their experiments have not yet been received. Professor Truscott's proposed modifications of slime treatment are being tested on a working scale at Dolcoath. A research on the separation of tin from its ores by volatilisation as chloride has been made by Sir Thomas Kirke Rose and Mr. J. H. Goodchild, and as a result the conditions have been determined under which a high percentage of tin can be extracted. With the present price of fuel, however, the cost of working appears to be prohibitive in the case of ores of the ordinary grade in Cornwall. Experiments with higher grade material containing 10 per cent. and upwards of cassiterite are in progress.

A proposal for the application of a new principle in concentration made by Mr. H. S. Hatfield, who has been retained by the Board, is being examined by him. He has obtained some promising results on a laboratory scale, and strong hopes are entertained that he will be able to work out a process preferable to the ore-dressing methods now in use. The principle can be applied to other purposes besides the concentration of tin ores.

Oxygen

Three sub-committees have been at work during the period under review. The first or Medical Uses Sub-Committee has been at work under Dr. Briggs upon problems arising in connection with the administration and transport of oxygen. For this purpose an oxygen workshop laboratory has been organised and equipped and a small liquid air plant installed at Edinburgh. A large number of papers have been written and circulated by this sub-committee, and in particular many experiments and reports have been made upon oxygen chambers for use in hospitals and wards. Arrangements have been made by which the work of this sub-committee will be transferred for the future to the full Committee, and will be confined to the engineering, physical and chemical aspects of problems connected with the medical uses of oxygen, leaving the purely medical side to be dealt with by the Clinical Sub-Committee of the Medical Research Council. Dr. Hunt has agreed to serve as a member of both Committees and will thus act as a connecting link between them. The study of containers and cylinders, of gauges and general appliances, of different systems of oxygen production and of aircraft and industrial uses has been divided between the sub-committees.

Lubricants and Lubrication

A Sub-Committee on the Chemistry of Lubrication has been appointed to review the existing information in this branch of the subject. The report of the Committee, which will be published at an early date, contains important recommendations as to the direction in which further fundamental work on oiliness should be carried. The work accomplished may be summarised as follows:—

(*a*) The compilation of a bibliography of the commercial, physical and engineering aspects of lubricants and lubrication.

(*b*) The compilation of abstracts of important papers relating to the chemical aspects of lubrication.

(*c*) The initiation of researches on certain fundamental problems.

(*d*) Tests and reports on special matters brought to the Committee's notice by outside firms.

(*e*) The preparation of two monographs on cutting lubricants and on solid lubricants respectively.

A bibliography is to be published as a separate document.

The department realise the great importance of continuing research into the theory and practice of lubrication, and have accordingly appointed a small Committee consisting of Mr. W. B. Hardy, Sir Richard Threlfall and Sir Charles Parsons, to prepare and direct a scheme of investigation.

Corrosion of Aluminium and Its Alloys

At the request of the Air Ministry a Research Committee has recently been appointed to investigate problems of the corrosion of aluminium and its alloys.

Copper, Zinc and Zirconium

Extensive inquiries have been made as to the improvements in copper and copper alloy products which users of these materials consider desirable.

It was frequently suggested during the war that zirconium-containing steels of remarkable hardness had been produced and were being employed by enemy countries in the production of light armour for aeroplanes and tanks. In July, 1918, a Zirconium Inquiry Committee was set up with the object of investigating the preparation of ferro-zirconium and, from the latter, of zirconium-containing steels. The experimental difficulties in the way of the production of a true alloy of iron and zirconium were numerous and severe, and after much work they were only partially overcome. It was found possible to prepare, in 50 lb. batches, a ferro-zirconium containing, however, a considerable proportion of carbon, while much of the zirconium in the material was present as carbide.

It was consequently very doubtful whether the zirconium in this material could be transferred into a melt of steel. In the the meantime numerous inquiries have failed to discover any source of supply of ferro-zirconium containing only small proportions of carbon and silicon, or any evidence that zirconium added to steel conveys to it any beneficial quality. Further, the examination of samples of light armour of enemy origin has not revealed the presence of zirconium. After the conclusion of the war the importance of the inquiry diminished and in consequence the Committee were of opinion that their investigations should be concluded.

"Trade Secrets"

The Committee point out that in certain industrial groups there are factors militating strongly against the establishment of research associations. Amongst these factors are :—

(*a*) The prevalence of very large economic units in the industry—the great chemical industries, such as the making of dyes, of heavy chemicals, of explosives, and of soap, they state, all exhibit this feature. Each of them includes in the main units which from their great financial strength are able to carry on the research they need, and consequently no research association has been formed for their benefit.

(*b*) Existence of Trade Secrets in the Industry.—The experience gained by the department indicates that "trade secrets" are often not really secrets; but in such an industry as dye-making, where complex organic compounds are synthesised, there are sometimes short cuts in a process, the knowledge of which is of great value to the firm possessing it. An industry whose members believe they possess "trade secrets," whether real or imaginary, is not likely to establish a research association without first counting carefully the cost of doing so.

The Affairs of John de Lys'e

A SITTING for the public examination of Mr. John de Lysle, 47-8, Berners Street, W., was appointed to be held on September 14 before Mr. Registrar Stiebel at the London Bankruptcy Court.

Mr. W. P. Bowyer, Senior Official Receiver, reported that the receiving order was made on July 9, and the debtor a few days later attended before the Examiner and gave some particulars regarding his affairs generally. After that his movements, so far as the Court was concerned, were a blank, and a statement had appeared in the public press to the effect that he "flew to France" on July 14. A warrant for his arrest was obtained on July 15, but it had not yet been executed.

The sitting was adjourned.

The Affairs of E. Gihl & Co., Ltd.

IN pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of E. Gihl & Co., Ltd., 61, Old Broad Street, London, E.C., was held on Thursday, September 16, at the Institute of Chartered Accountants, Moorgate Street, E.C. The chair was occupied by Mr. P. G. Payne, of Lovering, Payne & Co., C.A., 36, Basinghall Street, E.C., one of the liquidators, who said that owing to the complicated nature of the business no accounts showing the position could be submitted to the meeting, and he was quite unable to say the exact amount of the liabilities or what the assets would produce. A good many of the claims of creditors were subject to contra accounts, while other creditors held goods against advances. Speaking broadly, he thought he could say that the unsecured liabilities were in the neighbourhood of £60,000, but they might prove to be in excess of that figure, or even less. The assets were problematical. Many of the items which appeared as assets in the balance-sheet were the subject of arbitration, while others were in dispute. Within the last few months, owing to the fluctuations and falling markets, it was impossible to estimate what the stocks were worth. If it was necessary to close down now he did not think that many thousands would be realised for the creditors. If, on the other hand, they conserved the assets and could sell the business as a going concern, a very much better realisation would take place. There was a large potential value in the goodwill in spite of the disastrous trading of the past year or two. The position was discussed at some length, and eventually it was unanimously decided that a committee of three of the principal creditors should be appointed to act with the liquidators in the voluntary liquidation of the company.

Mr. A. E. Fletcher

MR. ALFRED EVANS FLETCHER whose death, in his 94th year, took place on Wednesday, September 15, was well-known in the world of science. After completing his school education in Berlin he returned to England to work as an engineer. Later he studied mathematics and chemistry at University College, London, where he won the gold medal in 1851. He was elected a Fellow of the Chemical Society in 1852. For some years Mr. Fletcher was among those who endeavoured to develop our native aniline dye industry, then in its infancy, though on the eve of yielding its chief fruits to the better political and scientific organisation of the Germans. Final discouragement came to him in this field through an attack upon the validity of a patent for an aniline process in which he was interested, and which he established in the House of Lords only after long litigation. In 1863 he accepted an invitation to assist Dr. Angus Smith, the first Chief Inspector appointed under the Alkali, &c., Works Regulation Act of that year, which gave powers for restraining the poisonous fumes till then discharged at the manufacturers' free will over vast districts round the industrial centres. Mr. Fletcher devised an aspirator for the rapid extraction and analysis of chimney gases, and an accurate anemometer for measuring the rates of flow in flues and chimneys; both these remained for many years in routine use. This Act of 1863, by its early practical results which these and other devices made possible, proved to be one of the most important health measures of the last century. At the same time, the initial hostility of the manufacturers was converted into gratitude when it became clear that many of the poisonous products they were forbidden to discharge had immense economic value. In 1884 Mr. Fletcher succeeded Dr. Angus Smith as Chief Inspector, and he retired in 1893. For some years previously he had also assisted the Scottish Office in the administration of the Rivers Pollution Act. He brought the coal smoke nuisance before the British Association meeting in 1870, and he worked strenuously for the next 30 years towards its abatement.

Dr. W. H. Ellis

THE death took place recently at Lake Joseph, Muskoka, in his 75th year of Dr. W. H. Ellis, former Dean of the Faculty of Applied Science, Toronto University. For over forty years Dr. Ellis had been on the teaching staff of Toronto University. He held various lectureships until the year 1887, when he became Professor of Applied Chemistry at the School of Practical Science. His services to the University finally culminated in his being made Dean of the Faculty of Applied Science, a position from which he retired only a little over a year ago, in May, 1919. Dr. Ellis was a native of Bakewell, Derbyshire (England). After going to Canada became a student at the University of Toronto, attaining the degree of B.A. in 1867, and Master of Arts in the following year. In 1870 he graduated in medicine, and in 1871 became a licentiate of the Royal College of Physicians (England). He was a Fellow of the Institute of Chemistry and a member of the Royal Society of Canada. He was also a member of the Society of Public Analysts of Great Britain. He was twice president of the Royal Canadian Institute. In 1895 he was appointed a Senator of the University of Toronto. The work that Dr. Ellis did for the advancement of science in Canada, it is stated, cannot be measured.

Books Received

REPORT ON THE TRADE OF SOUTH AFRICA FOR THE YEAR 1919. By W. G. Wickham. London: H.M. Stationery Office (Cmd. 956). Pp. 50. 6d. net.

TREATISE ON CHEMISTRY. By the Right Hon. Sir H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S. Vol. I., The Non-Metallic Elements. Macmillan & Co., Ltd. Pp. 968, 30s. net.

A director of the Bataafsche Petroleum and Royal Dutch Companies states that the REMOVAL OF THE SHELL CO. to Holland has not yet, he understands, been seriously considered, but that if this should happen properties at The Hague are already at the disposal of the company. The Dutch Treasury would profit from the removal, and the Shell Co. would not have to pay the high British taxes.

Reviews

CATALYSIS AND ITS INDUSTRIAL APPLICATIONS. By E. Jobling, M.C., B.Sc. Second Edition. (Textbooks of Chemical Research and Engineering, edited by W. P. Dreaper, O.B.E.). London: J. & A. Churchill, 1920. Pp. 144+ VIII. 7s. 6d. net.

The second edition of the above work will be welcomed by many who desire to have a concise summary of the technical applications of catalysis. Without attempting anything very novel either in scope or in the manner in which the subject is treated, the author has condensed into the 144 pages which the book now occupies a great deal of general information dealing with the more important industrial processes in which catalysis plays a part. Two new chapters have been added, of which the one dealing with the synthesis of alcohol and of acetic acid is of particular interest.

A possible ground for criticism might be the lack of quantitative data, but this is readily explained by the extent of the ground covered, and by the consequent necessity for dismissing the majority of catalytic processes in a few lines. The book is recommended as an accurate and up-to-date epitome of its subject. E. B. M.

ORGANIC CHEMISTRY. By A. Killen Macbeth., D.Sc. (Longmans, Green & Co. 6s. 6d. net.)

This is an engaging little book of some 200 pages, which has been written primarily for medical, intermediate science, and pharmaceutical students. Many of those who, having a deep knowledge of organic chemistry, attempt to write for the beginner invariably seem to overlook the fact that they were once beginners themselves; the result is that the novice is taken beyond his depth within the first few pages. Dr. Macbeth, however, is well able to form an estimate of the perceptive qualities of average elementary students owing to the fact that he has been directly in touch with them, and can thus appreciate the difficulties encountered. The result is that, while the subject matter of his little volume is naturally limited, it is presented in such a way as to stimulate a desire for the reader to pursue his studies further.

The opening chapters of the book deal with fractional distillation, purification and the general examination of an organic compound; and, after making such processes quite clear, the author leads on to the question of classification, the study of homologous series, &c. As is customary, he considers, firstly, the paraffin hydrocarbons, but points out in his lectures that he has often adopted the practice of dealing with aromatics and paraffins consecutively, instead of rigidly isolating them. This system presents advantages, for the student is enabled to note the similarity of synthetic methods, and can compare and contrast the properties of corresponding compounds of the two main groups as his study proceeds. Possibly, however, such a course may be criticised by the majority of teachers, who prefer more orthodox, if less helpful methods. The concluding portions of the book—which is particularly free from errors—is given up to the more elaborate products found in nature and technical processes. A. M.

Italian Decoration for Captain Wedgwood Benn

THE King of Italy has conferred the Italian War Cross upon Captain Wedgwood Benn, M.P., for services rendered during the war in connection with the Italian Flying Corps. This is the second Italian decoration awarded to Captain Benn, who was decorated with the Medal for Valour after his spy-dropping exploits on the Italian Front, for which he also received the D.F.C.

Recent Wills

Mr. F. R. Squire, of San Remo, Italy, chemist	£1,857
Mr. W. R. H. Sprackett, of Bristol, chemist	£10,488
Mr. J. N. Wright, of Heavitree, Devon, chemist and druggist	£13,147

STRAW GAS, which it is hoped may be suitable for driving automobile engines, is being produced by the United States Government in experimental quantities at a plant in Arlington, near Washington. It is stated by Government scientists that ordinary straw is used to make the gas.

Development of Alcohol Fuel

To the Editor of THE CHEMICAL AGE.

SIR,—The Empire Motor Fuels Committee of the Imperial Motor Transport Council is dealing actively with the general conditions underlying production and development of alcohol for power and industrial purposes. It has recently appointed small Expert Committees to deal with—

(*a*) The modification of Customs and Excise restrictions in connection with alcohol.

(*b*) By means of experiments, the best conditions for developing the alcohol engine and types of alcohol fuels—alone or in mixture—for the purpose; and

(*c*) The very important subject of denaturation (or rendering alcohol unpotable.)

Good progress is being made with the work of all three Committees, but it is felt that members of the public who may have given special attention to the question of denaturation of alcohol should be invited to forward any suggestions for confidential examination and report by the Denaturation Committee. Any such communications should be addressed to Sir Charles Bedford, LL.D., D.Sc., Empire Motor Fuels Committee, 50, Pall Mall, London, S.W.1, marked "Denaturation," and will be treated as strictly confidential. Any suggestions which may prove practicable will remain the sole property of the proposer. It is essential that any proposals regarding denaturants should be made with the knowledge of the particular requirements of a satisfactory denaturant—viz.:—

(*a*) Deterrent taste and smell; (*b*) non-poisonous; (*c*) must not be removable at a commercial cost; (*d*) must be readily detectable in small quantities; (*e*) must be readily mixable with the spirit; and (*f*) must be inexpensive.

It is, of course, exceedingly difficult to obtain any one substance which will conform to all these requirements; but the difficulty in practice has usually been overcome by using a combination of substances whose complementary action meets the requirements. It is inevitable that many suggestions will be made which fail to meet these requirements; but it is believed that a successful object will be attained by letting those interested know that there exists a small expert body, acting solely in the public interests, which is prepared to examine confidentially any proposals regarding denaturants. In the event of any such suggestions proving workable, the inventor would be communicated with and his interests fully safeguarded before proceeding to communicate the results to the Empire Governments concerned.—Yours, &c.,

50, Pall Mall, S.W.1, F. G. BRISTOW.
September 17, 1920. *Hon. Secretary.*

Motor Legislation Committee and Petrol Prices

THE Motor Legislation Committee, in a statement to the Government of the serious effect of the recent increases in petrol prices, recommend:—

1. That the agreement between the Anglo-Persian Co. and the Shell Co. be reviewed, so that the distribution of motor spirit under the agreement be available through agencies independent of the two large trusts.

2. That all statutory gas companies having an annual consumption of not less than 5,000 tons of coal be compelled to instal, within a limited period, the necessary plant for the production of crude benzol (if this were done there would be at once available a further 30,000,000 gallons of motor spirit annually).

3. That the Government take such steps as will ensure that the output of benzol is available to the public at a reasonable price, and is in no sense controlled by the Shell or Anglo-American Oil Companies.

4. That the Petroleum Executive be asked to consider what further steps can be taken to develop oil production in this country, and how far it may be possible for the larger consumers of coal to carbonise the coal consumed, so that all the by-products may be recovered.

5. That facilities be provided for storing, transporting and retailing power alcohol under regulations similar to those applicable to other types of motor spirit.

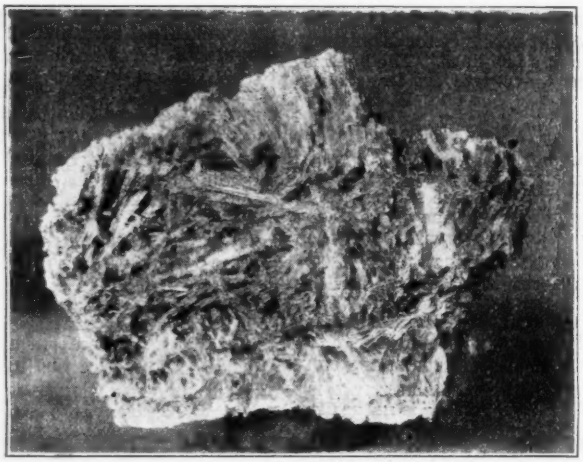
6. That the existing restrictions in relation to the installation of storage tanks be reviewed, and that there should be a right of appeal to the Minister of Transport in cases where local authorities refuse consent to the installation of such tanks.

Natural Soda Deposit at Lake Magadi, B.E.A.

The following notes respecting the huge deposits of natural soda in Lake Magadi, British East Africa, are of interest as indicating a new supply of apparently unlimited dimensions.

THE discovery of the remarkable deposit of Natural Soda known as Lake Magadi, in British East Africa, has been known for some time, a company formed to exploit the lake being floated in 1911. In the *Bull. Soc. Ind. of Northern France*, July 1919, M. Paul Kestner wrote at length on the deposit, its potentialities, and its value.

Lake Magadi is situated in the heart of what was a few years ago darkest Africa, about 60 miles south of Nairobi, and is 30 square miles in area. The solid soda which comprises practically the whole of the lake is perfectly level, hard and dry on the surface; but wherever the surface is broken the mother liquor rises to its level, and when the crystalline blocks are removed the liquor drains from the interstices of the crystals. The great purity of the soda is most likely due to this large amount of soda in solution distributed throughout its mass. The crystalline deposit cleaves readily into blocks, from which the mother liquor rapidly drains, leaving a friable mass of crystals.



BLOCK OF SODA CRYSTALS.

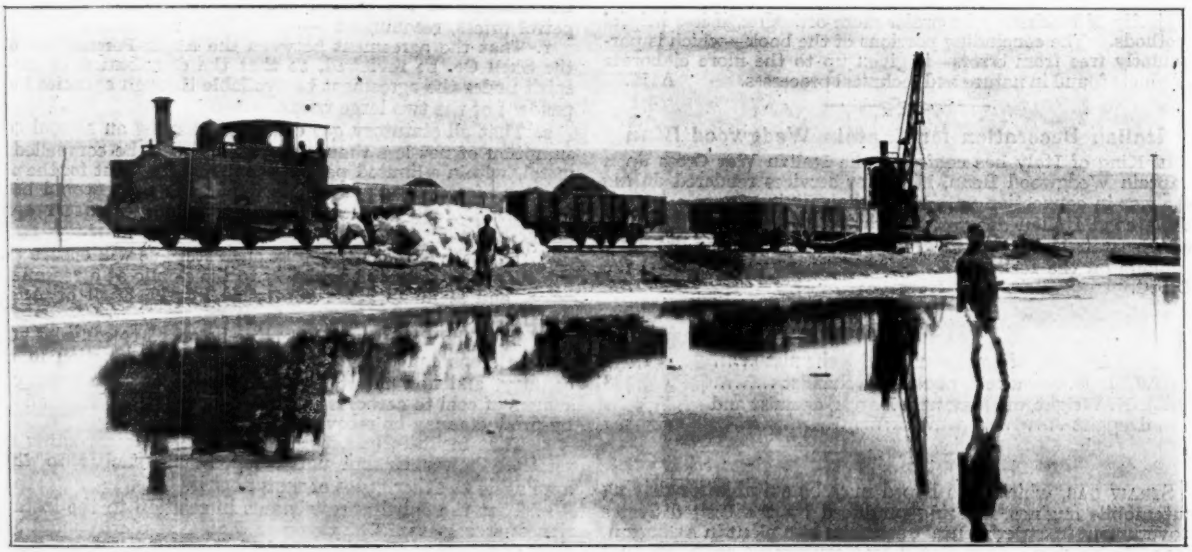
A brief description must suffice of the method by which the soda is taken from the lake, and for which plant is being constructed. A pontoon dredger is used to scoop the soda out of the lake. The dredger is connected by flexible piping to a fixed pump which in turn is connected by rigid piping to the shore. During its transit from the pontoon to the shore by means of this piping, the soda undergoes a preliminary washing It is then washed thoroughly and goes to the calciners. From there, it is bagged and sent down by rail to the coast.

The Magadi Soda Co., Ltd., have constructed a railway 91 miles in length to connect with the Uganda Railway, which has its terminus at Kilindini (Mombassa), and the Company have their depot and deep-water pier there, whence the soda is shipped

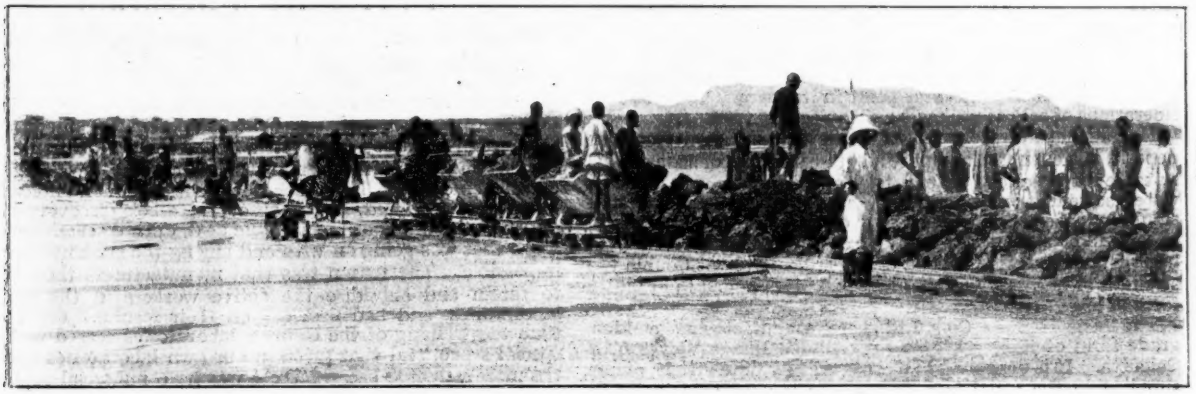
The working of this valuable soda deposit at Magadi has been long desired both by the colonists and the Government of British East Africa, as naturally the colony will greatly benefit by the establishment of such an important commercial undertaking. The great feature of the deposit apart from its vast extent (being calculated to contain two hundred million tons of soda) is the extreme purity of this natural soda product, and the fact alone that it is free from sulphur-impurity places it on an entirely different level from other natural soda deposits.

Tests have from time to time been made by independent analysts, all of whom confirm its great purity. Mr. Gordon Salamon has reported that "the total amount of soda present, calculated as soda (Na_2O), amounts to 40·38 per cent., which upon the calcined product would amount to 58·08 per cent. soda (Na_2O) or 99·3 per cent. dry soda ash (Na_2Co_3)." He also stated that the absence of sulphate of soda distinguishes the Magadi deposit from all other natural deposits of soda which he has examined, and enables the calcined Magadi soda to be economically employed for industrial purposes. Further, Messrs. Teschemacher & Denham reported that they believe the "ash" which they had obtained from Magadi soda to be "superior to any at present met with in commerce."

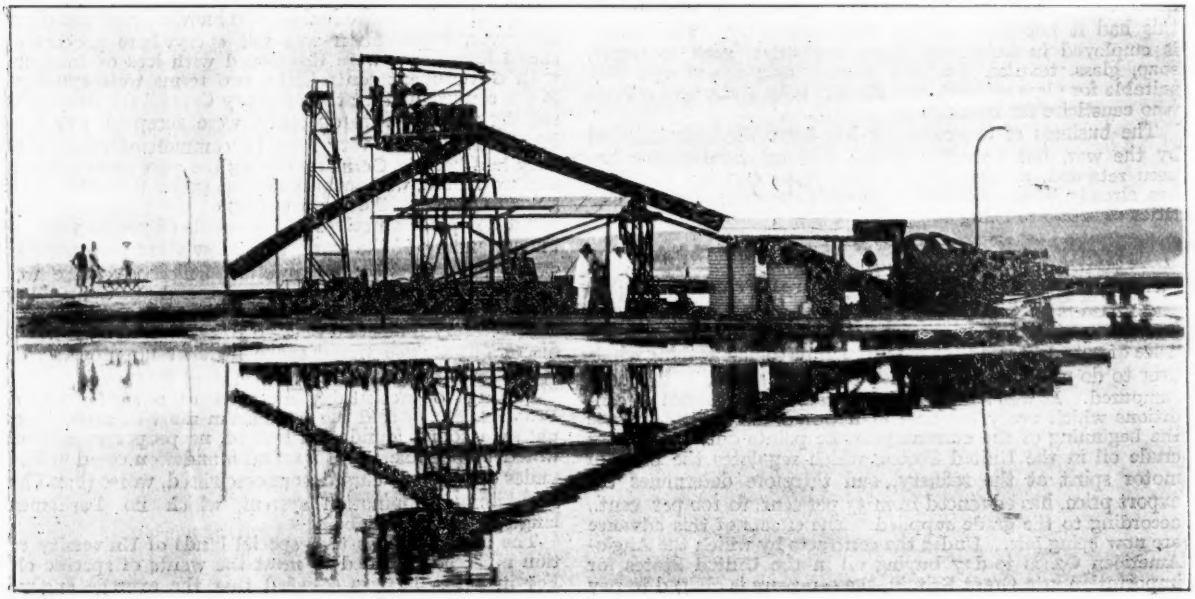
The soda in its natural form is a crystalline sesqui-carbonate



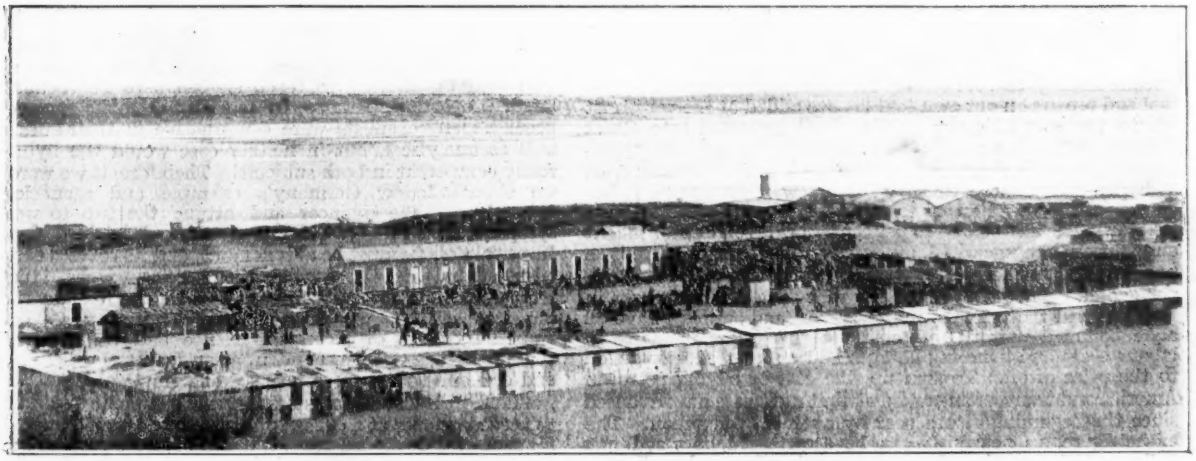
ENGINE AND TRUCKS FOR TRANSPORT TO PIERHEAD.



NATIVES DIGGING OUT SODA AND TROLLEYING IT TO PIERHEAD (OLD METHOD).



PONTOON EXCAVATOR FOR DIGGING OUT SODA (NEW METHOD).



GENERAL VIEW OF NATIVE COMPOUND AND SODA LAKE.

of soda, which, when calcined, yields a pure carbonate of soda (soda ash) that is capable of being readily and cheaply converted into caustic soda, soda crystals, bicarbonate and other soda products of the greatest purity. The density of pure Magadi soda ash corresponds to what is known as "heavy" finish, which is an important point in its favour, both for considerations of sale as well as for cheap cost of transport.

Magadi natural soda, which is the raw material from the deposit, is a commercially pure sesqui-carbonate of soda, and is suitable for a variety of industrial and domestic uses, such as water softening, wool scouring, soap making, washing and scrubbing of all kinds, cleansing of utensils, the prevention of scale in boilers and for many other purposes. It can also be used as a substitute for soda crystals, being about double the strength of ordinary washing soda. It is supplied in granular form in bags.

The Magadi Soda Co., Ltd., are manufacturing a high grade form of this article at their Budge Budge Works near Calcutta. It is described as a commercially pure article, and is supplied in the usual iron drums. It is used principally in the manufacture of soap, paper, aluminium, oil refining, textile industries, drugs and dyes.

The company state that they will shortly be in a position to supply Magadi pure soda ash (58° standard alkali) in large quantities. The production would have begun long before this had it not been for the war intervening. This article is employed in numerous staple industries, such as paper, soap, glass, textiles, &c., and Magadi soda ash is especially suitable for glass making, and also for soap and paper makers who causticise for themselves.

The business of the company has been adversely affected by the war, but notwithstanding that its development has been retarded, a regular trade with India and the Far East has already been established, to which markets large quantities of soda are being shipped.

Causes of Increased Petrol Prices

Mr. Francis E. Powell, chairman of the Anglo-American Oil Co., in explaining the causes which led to the recent rise in the price of petrol, states that the jump in price had nothing whatever to do with the contingency of a coal strike, as has been rumoured. It was simply the inevitable consequence of conditions which every business man would understand. Since the beginning of the current year, he points out, the cost of crude oil in the United States, which regulates the price of motor spirit at the refinery, and therefore determines the export price, has advanced from 35 per cent. to 100 per cent., according to the grade supplied. The effects of this advance are now being felt. Under the contracts by which the Anglo-American Co. is to-day buying oil in the United States for importation into Great Britain, the company is obliged to pay 5½ cents per American gallon over what it paid in the early part of the year. This is equivalent to 4½d. per imperial gallon. Directly the stock of cheaper spirit bought under earlier contracts was exhausted, it became obvious business an necessity for the company to add 4½d. per gallon to their selling prices here.

"But that is only one factor," Mr. Powell continued. "Since the beginning of the year the expense of chartering outside tonnage and of meeting the increased charges for wages, fuel and repairs on our own tankers has added at the very least ¾d. to the cost of every gallon of oil imported into Great Britain. That is a most moderate estimate. Merely, therefore, to buy oil in America and to bring it to this country costs 5¼d. per gallon more than it did a few months ago. Now comes in the question of transportation costs within Great Britain. The advance of 40 per cent. in rates on Sept. 1 meant an additional charge of ¾d. on every gallon, so that there is in purchasing and transportation a total advance in cost of 6¼d. per gallon. Since the first of the year wages at our works in England and the prices of material, tins and supplies have all alike bounded upwards. I estimate that these increases in labour costs and handling charges add at least 1d. per gallon to the price of oil. To sum up, the cost of buying petrol in America and transporting and distributing it here has advanced since the beginning of the year by over 7d. per gallon. The exact figure, as nearly as can be ascertained, is 7·27d. per gallon. Yet the price of petrol was only advanced on Sept. 1 by 7d. per gallon."

University Education

Professor Armstrong on Our Soul-killing Methods

In an address to the Old Students' Association of the Royal College of Science last week, Professor H. E. Armstrong, F.R.S., dealing with the pre-Kensington history of the Royal College of Science and the University Problem, made some strong remarks upon our system of scientific education.

Referring to the manner in which Germany developed her chemical industries, he said that when the German universities were commercialised, largely through Kolbe's discovery of his method of manufacturing salicylic acid, open discussion of the work that was going on with and among the students became impossible. The reason was that manufacturers then began to retain and subsidise the active workers in the various laboratories, and had first call on their results. From that time the training of the German laboratories ceased to be of special value, and that given in our own laboratories became the more valuable because there was no commercial object in view. During the war the value of scientific enquiry had been dinned into the public ear, and the consequences of our comparative neglect of such work had been proclaimed far and wide. There was, however, a danger that we might overdo things in our efforts to improve. The talk was largely artificial, and by those who had no real knowledge of the situation. Moreover, organisation was not everywhere proceeding on sound lines. We were threatened with loss of freedom and with Government control, the two terms were synonymous. If the conditions that the Advisory Council for Research were seeking to carry into operation were accepted, our teaching institutions would very soon be commercialised in the way they had been in Germany during the past 30 years or more, and we should, without fail, kill the goose that was to lay the golden eggs, *i.e.*, the free working of the original mind. We could not place ourselves in the hands of people who had no understanding of the work, and allow them to control it and worry us constantly for results. Unless scientific workers constituted themselves a trade union and put down all public interference with their work, and unless they were trusted with the necessary funds and allowed to act according to their own discretion, science would make little or no progress.

Present-Day Educational Methods

Passing to present-day methods of scientific education, Prof. Armstrong said the same claim must be made, because, unless a sound foundation be laid, no proper superstructure would be possible. But a sound foundation could not be laid under our present cursed, commercialised, worse than Chinese, soul-killing examination system, which no Parliamentary language could describe.

The need now was that special kinds of University education must be provided to meet the wants of specific classes. For instance, he was satisfied that the average engineering student and the average chemical or physical student were of two quite different types of men. The engineering student shied at chemistry and physics, and rarely acquired sympathy with either subject, not because he did not want to learn them, but because their method made no appeal to his intelligence, the habit of mind of the engineer being constructive whilst that of the chemist and physicist was analytical and introspective. Chemical engineers were being much asked for. A few might be raised by striving to teach engineers to be chemists; a larger proportion, perhaps, by teaching chemists engineering, because many chemists were constructive in their outlook as well as analytical, but in neither case would the hybrid be really competent in both subjects. Therefore, if we were wise we should follow Germany's example and manacle the chemist with the engineer and attune the two to work in sympathetic vibration. For these reasons he held that the Imperial College must be autonomous, and its courses carefully adjusted to suit the special peculiarities of its students. He would leave the Imperial College to deal with physical science, would constitute University College an Imperial college of biological science and technology, and convert King's College, London, as an Imperial college of arts and economics, the three forming one Imperial University of London. Under such a federal scheme a student would be free to attend courses at a college of his own, and would have credit for such outside attendances, and, although his proposals might seem revolutionary, we needed a revolution in education to make it effective.

The Paint and Varnish Industry in Canada

The particulars given below respecting the paint and varnish industry in Canada in 1918 are taken from an advance chapter of "Chemicals and Allied Products in Canada," prepared under the direction of S. J. Cook, B.A., F.I.C., chief of the Mining, Metallurgical and Chemical Division, Ottawa. The report is available for free distribution to those interested, and those desiring copies should communicate with the Dominion Bureau of Statistics, Ottawa.

FORTY-FIVE establishments making paints or varnishes or materials destined for use in the paint and varnish industry, were in operation in Canada during 1918. The total assets of this industry, including the value of the land, buildings, fixtures, machinery, tools, materials and finished products on hand, together with the operating and trading capital, aggregated $15,784,610. The principal materials used in this industry were valued at $9,203,530, and from them principal products to a value of $17,678,049 were made. Thus the value added to the materials used, by the process of manufacturing, was $8,474,519. Miscellaneous expenses chargeable to manufacturing operations were $2,315,881.

The extensive use of zinc oxide and lithopone as paint pigments is reflected in the figures shown below. Basic carbonate white lead is still used in larger quantities than any other one pigment, but recent advances in the study of paint pigments have shown that zinc oxides and lithopone are very desirable pigments for certain uses. The following table shows the quantities and value of the materials used in the paint and varnish industry in Canada in 1918 :—

	Quantity.	Value.
Oils—		
Chinese wood oil	257,620 gal.	$594,855
Linseed oil, raw	1,297,727 gal.	1,963,110
Thinners and Solvents—		
Alcohol	138,558 gal.	179,618
Creosote	53,073 gal.	13,747
Naphtha	904,673 gal.	286,053
Turpentine	426,344 gal.	319,592
Acetone	42,213 lb.	15,932
Benzine, paraffine, &c.	2,863,110 lb.	166,711
Benzol	338,639 lb.	16,133
Gums and Resins—		
Gums	1,750,941 lb.	417,434
Resins	3,598,292 lb.	174,912
Pigments and Driers—		
Acetate of lime	20,845 lb.	1,480
Zinc oxides and lithopone	7,108,248 lb.	721,527
White lead	1,402,636 lb.	168,255
Colours and pigments	—	1,233,695
Fillers—		
Asbestine	3,738,230 lb.	24,325
Barytes	4,326,670 lb.	76,278
Whiting	8,422,275 lb.	116,817
Pig lead	10,593,351 lb.	874,638
Other chemicals		210,020
Containers and other materials		1,628,398
		$9,203,530

In 1918 three firms in this industry corroded pig lead to make dry white lead and white lead ground in oil. 10,593,351 lb. of pig lead valued at $874,638 were used in the production of white lead, dry, and in oil, and litharge. Practically the whole of this was made by the "quick process." The quantities made, with their respective selling values, were :—

	Quantity.	Selling Value.
White lead, dry	4,030,367 lb.	$473,922
White lead in oil	8,456,236 lb.	1,083,552
Litharge	1,421,686 lb.	266,974

Six other establishments used 1,171,651 lb. of white lead, dry, costing $132,736, for the preparation of 941,013 lb. of white lead ground in all, having a sales value at the factory of $136,578. 7,483,893 gallons of paints in oil, prepared ready for use, were reported as being manufactured during the year. The total selling value at the plant was stated to be $8,613,973.

A study of white paints carried out during the year in the laboratories of the Department of Trade and Commerce showed that 73 different brands were being offered for sale on the Canadian market. The composition of each was carefully determined and it was found that a great variety of formulæ were in use. As pigments, basic carbonate white lead, basic sulphate white lead, leaded zinc, zinc oxide and lithopone, were found, while barytes, blanc fixe, satin white, whiting, asbestine and silica were often present as fillers, sometimes to quite a considerable extent.

The products made in the paint and varnish industry in Canada in 1918 are shown below :—

	Quantity.	Value.
Linseed oil, boiled and refined (sold)	113,256 gal.	$211,335
Paints in oil (ready for use)	7,483,893 gal.	8,613,973
Paste paints	33,500 lb.	3,460
Colours in oil and Japan	27,800 lb.	5,142
Varnishes, all kinds	3,317,069 gal.	3,764,555
Japans and lacquers	209,249 gal.	251,856
Shellac	81,704 gal.	309,975
Stains	216,274 gal.	276,665
Dryers	105,868 gal.	105,401
White lead, dry	4,030,367 lb.	473,922
White lead, in oil	11,874,260 lb.	1,545,918
Lampblack and other carbon black	62,939 lb.	6,878
Oxides of lead (litharge, red lead, &c.)	2,432,936 lb.	268,624
Iron oxides	748,750 lb.	44,925
Dry colours	335,000 lb.	76,926
All other pigments	3,535,213 lb.	404,770
Barytes	1,236,000 lb.	12,400
Putty and other fillers	5,178,405 lb.	280,581
Asphaltic pitch & tar products	—	38,463
All other miscellaneous products	—	982,280
		$17,678,049

The total value of exports from Canada in 1918 of paints, varnishes, &c., was as follows :—

	Quantity.	Value.
Cobalt oxide and cobalt salts	588,229 lb.	$853,737
Mineral pigments, iron oxides, ochres	15,389 cwt.	18,377
Paints and varnishes of all kinds	—	1,239,999
		$2,112,113

The imports into Canada during 1918 of paints, varnishes, &c., and materials used in the paint and varnish industry were as follows :—

	Quantity.	Value.
Amyl acetate and acetone	—	$2,354
Gums, amber and arabic	—	1,130,508
Flaxseed or linseed oil, raw or boiled oil	78,191 lb.	12,370
Rosin oil and Chinawood oil	—	771,172
Blanc fixe and satin white	7,054,186 lb.	92,241
Brocade and bronze powders	—	47,950
Gold liquid paint	—	6,822
Lamp black, bone black, carbon, ivory black	2,355,364 lb.	250,284
Lead, red, dry and orange mineral	896,831 lb.	83,725
Lead, white, dry	367,755 lb.	30,874
Lead, white, ground in oil	38,642 lb.	4,166
Liquid fillers, anti-corrosive and anti-fouling paints, and ground and liquid paints	3,380,035 lb.	390,653
Litharge	19,479 cwt.	170,500
Ochres, ochrey earths, siennas and umbers	3,119,801 lb.	66,011
Oxides of cobalt, tin and copper, metallic colours	142,407 lb.	73,989
Paints and colours, ground in spirits and all spirit varnishes and lacquers	7,665 gal.	31,744
Putty	385,589 lb.	14,564
Ultramarine blue, dry, or in pulp	427,909 lb.	86,740
Whiting, gilder's whiting, and Paris white	209,743 cwt.	190,162
Zinc white	16,693,824 lb.	1,723,396
Varnish lacquers, Japan driers, liquid dryers and oil finish	36,240 gal.	71,836
Coal tar base or sale (paranitraniline)	96,458 lb.	63,803
Resin or rosin in packages of not less than 100 lb.	342,552 cwt.	1,106,145
Turpentine, raw or crude	59,451 lb.	4,284
Turpentine, spirits of	1,007,029 gal.	583,543
Total		$6,309,836

The survey of the paint and varnish industry for 1919, now in process of compilation, will review the industry in better detail than has been possible heretofore.

Restriction of Imports of Dyestuffs

Critical Attitude of Calico Printers to Prospective Government Policy

At the ordinary general meeting of the Calico Printers Association, Ltd., held in Manchester on Wednesday, September 15, an important statement was made by the Chairman outlining the Association's attitude to the prospective Government scheme for the restriction of imports of dyestuffs under a licensing system.

Acute Colour Shortage

The current situation (he said) as regards supply of essential dyestuffs is no less perplexing than it was on the two previous occasions on which I addressed you. During the year just concluded we have passed through a period of colour shortage not less acute than that which obtained during the critical years of the war, and it has only been by the dyes received from Switzerland and America (and since the date of the Sankey judgment. from Germany also) that the colour-consuming trades have been able to preserve a reasonably full volume of production, and so contribute their share to that re-establishment of industry which is the primary necessity of our national existence. This period has seen the emerging of the two principal firms of English colour-makers into one highly capitalised corporation, a step taken under Government pressure, and one which we always maintained was to the advantage of neither the colour-making nor the colour-consuming trades. Our objection has from the first been that any scheme aiming finally at the concentration of the dye-making works of the country into one monopolistic enterprise would in practice disorganise the working mechanism and *esprit de corps* of the firms amalgamated, it would increase the overhead working costs, stifle that healthy rivalry which is one of the main inducements to economical, efficient and progressive working, and furnish the opportunity for price inflation irrespective of manufacturing costs. We are glad to note that our view is gaining a wider public recognition that the foundations of dye manufacture must be broadened if the maximum of efficiency in production is to be secured.

Despite the unsettlement that has hampered colour production in the past year, some progress, however, is now being made. The stringency in the supply of the commoner dyestuffs at the moment is somewhat relieved, and limited quantities of some of the finer and more specialised colours have recently been put upon the market. It would, however, be unwise to found upon the progress made any expectations of an early or complete dependence on a home production adequate in quantity, variety and excellence, and the necessity of keeping open the source in the first place from Switzerland, and supplementary to this from Germany, is no less insistent than it has been in past years. The leeway still to be made up is so great—the advances that will be made by other countries, and by Germany in particular, in research and discovery, widening the ranges of colour and expanding the possibilities of its application, are so certain that no channel must be closed to the British colour-consumer which would furnish him with the colours necessary to produce goods of the excellence possible to his foreign competitors. Hence the necessity which is becoming day by day more insistent for the framing and adoption of a statesmanlike policy.

A Choice of Four Policies

Four alternative courses have been suggested for meeting the situation—(1) free imports; (2) a tariff; (3) subsidy; and (4) licensing.

The first two may be ruled out, as free imports are declared by the Government to be inadmissible, whilst the policy of protection by tariff does not command that general approval which alone would render its adoption possible. Of the remaining two, that of subsidy, under which the nation would pay for the protection it demands, commends itself as a safe and equitable policy to pursue. This, however, the Government declined to entertain, though why a policy which was applied even in pre-war times to the key industry of shipping should, when suggested for the colour industry—which is an exact parallel—be peremptorily rejected certainly requires more explanation than a simple *non possumus*. In view of the refusal of a subsidy we have suggested that, following the course adopted for the encouragement of an Empire Cotton Growing Industry, the consumer of dyes might in like manner voluntarily place himself under an assessment reckoned on the colour he uses to form a fund under Government control out of which a drawback could be accorded to the manufacturers in the home dye-making industry, but this proposal has met with no support.

The Policy of Licensed Imports

There is therefore left only the policy of licensing. This has already been tried and found to be cumbersome and inequitable, it has led to the practical control passing into the hands of officials; and has proved during its short life an unmistakable drag on industry.

As, however, it is the expressed intention of the Government to reintroduce legislation based on the Imports and Exports Regulation Bill, despite the public criticism which led to the withdrawal of that Bill, I will enumerate some safeguards which we consider essential to limit as far as possible the mischief inherent to any system of restricting by licence the import of colour :—

(1) The Licensing Committee must consist of practical men with technical knowledge. Its appointment by preference should be placed in the hands of the colour-consuming trades themselves, but, failing this, the personnel of the Committee must be submitted to and approved by these trades, and in any case their representatives must be in a majority.

(2) The colour-consuming trades must be consulted as to the machinery to be employed in carrying out the licensing system, and no system should be adopted which has not met with their approval.

(3) The onus of proof as to the suitability of a British colour to meet the needs of the trade must lie on the colour-maker and not upon the colour-consumer, and the evidence must satisfy a properly constituted technical committee which has the confidence of the users. Failing such proof free and prompt import of any colour should be granted.

(4) The period over which the system of licensing shall extend must be definitely limited, and at the close it shall automatically cease in such a way that it will be impossible to reimpose it without fresh legislation.

History of the Colour Problem

The necessity for caution in coming to a decision which is fraught with momentous consequences to the colour-using industry, and, indeed, the whole Lancashire cotton trade, is all the more evident if one looks backwards over the history of this colour question since the outbreak of the war. The advocates of protection found ready to hand an easy argument for pushing their views. The colour users on their side were uninformed, harassed, and disorganised. Finding themselves suddenly cut off from nearly all their usual supplies of colour, they urged the Board of Trade to action, many of the suggestions being mutually destructive, and the voices of the few who understood the subject were drowned in the general clamour. But the colour-maker knew precisely what he wanted—he wanted protection— and the whole history of the colour movement has been biased by the steady, persistent pressure put on the authorities by these interests, and the Government has proved an easy and perhaps not unwilling instrument. The policy of restriction being once adopted by the Government, and no restraint being exercised by the House of Commons (which was for the most part ignorant of the needs of the colour industry), the carrying out of this policy was left in the hands of a succession of high officials constantly coached by the colour-making interests. As a consequence the colour users were faced with the up-hill task of keeping open the door for the entry into this country of dyes essential to meet their need. As the course of events showed with growing certainty that these supplies would for a long time remain a vital necessity to the British consumer in the face of a world competition for trade, the argument of national safety which then emerged was cultivated assiduously by speeches and newspaper articles.

Colour Production

It is a significant pointer to the narrowness of view that has marked the whole history of the colour controversy that the

Government itself and the advocates of protection have confined their argument to colour-making works, and have made no reference to those works mainly engaged in the manufacture of heavy and fine chemicals, the plant required for which constitutes from the point of view of national security as important factors, if, indeed, not more important ones, than those of the colour-making plants themselves. Indeed, the huge German colour works, which have furnished the basis of this argument, are manufacturers of heavy chemicals on a scale comparable to that of the great alkali works in this country. This limitation of the claim for special protection to colour-making works alone emphasises the necessity that care should be taken that the plausible argument of public safety should not be allowed to be used as a stalking horse for the promotion of sectional interests, and before any final scheme is adopted the whole situation should be surveyed with a wider sweep than has been accorded to it in the past. The necessity for this is emphasised by the fact that the Government is scrapping the gigantic chemical and explosive plants which were erected at enormous cost during the war, and constituted an essential factor in our very existence as a nation.

Colloidal Chemistry & a Colloid Mill

By Hermann Plauson

AFTER discussing some of the elements of colloidal chemistry and the division of disperse phases into (1) mechanical or coarse suspensions, (2) colloidal solutions, and (3) molecular solutions, the author makes some important claims on behalf of what is alleged to be a new type of mill for extremely fine grinding in water or other medium. This mill is the "Kolloidmühle" or colloid mill, and is said to form the ideal apparatus for homogenising and emulsifying substances and for obtaining colloidal preparations, in recovering oil from oilcake and bleaching earths, the manufacture of colloidal or liquid coal, colloidal wood, plastic substances, phosphates, lignite, artificial milk, glue, colloidal mercury, soaps, and hydrogenated fats. He agrees with the Russian scientist, P. P. von Weimarn, that, with suitable apparatus, all matter is capable of assuming the colloidal form.

The various methods for the preparation of colloids may be completely classified under: I. *Dispersion Methods*—(*a*) organic disperse media, (*b*) cathodic distintegration (Bredig), or disintegration by means of oscillatory discharges, and (*c*) heat energy; II. *Condensation Methods*—(*a*) chemical reactions, *e.g.*, reduction by metallic salt solutions, (*b*) electrochemical reactions, (*c*) photochemical reactions, (*d*) molecular polymerisation. None of these methods is cheap or universally applicable, although a convenient method for grinding to colloidal fineness is one of the greatest needs of the chemical and allied industries to-day. The author began experiments in 1911 with coal, talc, graphite, &c., and in 1912 he designed a modified form of the ordinary druggists' "Perplex" beater mill (made by the Alpina-werke) and fitted the shaft with a stuffing-box to make the machine water-tight. By running at a very high speed, 40 metres at the periphery, a colloidal fineness was obtained, *i.e.*, particles of the order of 0·0001 mm. Different disperse media gave different results, whilst the addition of certain substances improved the fineness, *e.g.*, in the case of coal, alkaline solutions of glue and certain albuminoids such as lysalbic acid and its salts; in the case of graphite, tannin; with talc grinding a neutral soap solution was favourable; and glycerine or glycol was of advantage in preparing colloidal forms of sulphur, mercury, iodine, &c. Inhibitive substances such as acids and electrolytes must be avoided, and removed by washing or extraction. The ratio of the medium used to the substance to be ground is important, also the relative viscosity of the medium. Generally the process is extremely simple, and is as follows: 30 parts of the substance are treated with 70 parts of the disperse medium in a suitable apparatus, diluted with further quantities of medium, and left to stand in a columnar vessel for ¼ to 12 hours. The supernatant liquid is drawn off, further quantities of disperse medium added to the lower part, and the mixture again passed into the beater mill. The drawn off liquid is said to be homogeneous and a true colloid. An improved apparatus is now used called the Kolloidmühle (colloid mill), manufactured by the Maschinenfabrik Emil Passburg, of Berlin, and has already been successfully used on a large scale in a Hamburg works for the manufacture of colloidal cellulose. It consists essentially of one or two excentrically arranged discs or pistons carrying beaters of any desired form and rotating at a high speed. Instead of the beater solution of the ordinary disintegrator type friction may be used. A patent was applied for in 1914, and German patent No. 289,026 was granted in 1916 in the name of Georg Hanning, of Hamburg, but Plauson claims to have greatly improved the apparatus since then.

As examples of its manifold uses reference is first made to the petroleum industry, and the treatment of the naphtha sludge containing from 10 to 50 per cent. naphtha. By treating 10-20 parts of the sludge with 90-80 parts of water in the colloid mill it is claimed that the greater part of the residual naphtha was recovered. In a similar manner and by using small quantities of well-known emulsifying agents the oil content of oilcakes or bleaching earths may be reduced to 0·8-1·2 per cent. One of the most important applications of this new machine is in the manufacture of liquid or colloidal coal, to which the author devotes a great deal of space. Various other uses are described, and in particular the acceleration of chemical reactions by very thorough and intimate mixing. For instance, in the hardening of fats at 120-150° with a nickel catalyst the time required was reduced 50 per cent. by using a colloid mill fitted with a steam jacket, or if the same time was used the temperature could be reduced. Plauson claims that "by special experiments a new process of fat-hardening was evolved, and no ordinary nickel catalyst was required if the revolving parts of the mill were coated with nickel or palladium or the like substances." The process should thus be greatly simplified and cheapened.

In the same manner the manufacture of soaps can be simplified by using a steam-heated colloid mill. Much less water and less heat are required, and in an apparatus of 100 kilos capacity 30 times the amount of soap can be boiled in eight hours, showing a great saving in labour and running costs, and the resulting soaps were extraordinarily homogeneous. More water and fillings can thus be incorporated if desired. The writer hopes to give details of further experiments with his colloid mill in subsequent articles.—*Chem. Zeit.*, 1920, 553-555, 565-567.

Agricultural Research as a Career

A GRANT of £80,000 has been voted by Parliament this year for agricultural research. Most of this goes to the various institutions throughout the country, such as the Research Institutes attached to the School of Agriculture at the University of Cambridge; the Horticultural Research Station (the National Fruit and Cider Institute) at the University of Bristol; the East Malling Fruit Experimental Station, Wye College, Kent; Royal Veterinary College, London; the Ministry of Agriculture's Laboratory at Addlestone, Surrey; the Helminthological Institute at Birmingham University; the Rothamsted Experimental Station; and the Economics Research Institute, Oxford University. Besides these there are many others engaged on special lines of work, *e.g.*, the University College of Wales, Abersystwyth, has recently established a Chair of Plant Breeding; and experiments in connection with glasshouse crops are conducted at the Waltham Cross Experimental Station. Provision is also made for the investigation of special problems which lie outside the scope of the Research Institutions. Most of this work is of universal interest, but in order to deal with strictly local problems the Ministry of Agriculture has had in operation for several years a scheme under which advisory officers are attached to the provincial agricultural colleges for dealing with special local problems, especially plant diseases, concerning which advice is frequently sought.

Reference is made to the kind of career offered by agricultural research, and the need is acknowledged of providing sufficiently attractive emoluments for those engaged in this highly important national work. The Ministry of Agriculture admit that even now the rewards are not commensurate with the value of the work done, but at least "an honest endeavour has been made to improve the lamentably low emoluments and prospects." The Ministry has resumed the Research Scholarship Scheme which was in operation before the war and available for those capable of advanced agricultural research.—*Journal, Ministry of Agriculture*, July, 1920, pp. 301-303.

Sharples Super-Centrifuge

Recovery of Oil from Soap Stock

At a meeting of the Hull Chemical and Engineering Society, at the Reckitts' Institute, Hull, on Friday, Sept. 17, Mr. J. P. O'Callaghan, F.C.S., contributed the following paper on the design and uses of the Sharples Super-Centrifuge.

The expression "super-centrifugal force," he said, was used to connote a separating force far greater than that which it was possible to exert by means of an ordinary centrifuge. The most useful application of the Sharples Super-Centrifuge, therefore, lay in its ability to effect those separations and clarifications which were beyond the reach of the ordinary centrifugal. Among these were some of the most valuable and important waste-recovery processes yet attempted on the commercial scale.

To achieve such an improvement in the instrument of centrifugal separation a radical departure from the hitherto accepted design of centrifugal machines had been necessary. It had been ascertained that the degree of centrifugal force exerted by a centrifuge varied *directly* as the diameter of the bowl, but as the *square* of the number of revolutions per minute. This law gave the designers of the Sharples Super-Centrifuge their clue. Having regard to the strength of materials, it was obviously not practicable to make a very great increase in the diameter of the rotating member, and it was probable that the limit of safety had already been reached in this direction. They therefore sought to increase the speed of rotation. To do this it became necessary to diminish the diameter of the rotor, but having in view the law already mentioned, and the fact that the work for which the Sharples Super-Centrifuge was primarily designed lay mainly in the separation and clarification of liquids or the removal of relatively small quantities of solids from large quantities of liquid, they rightly decided that the necessary restriction in diameter was no disadvantage—in many cases, indeed, it was a positive advantage—whereas the enormously increased speed of rotation which the Sharples design made possible (a speed ranging from 18,000 revs. per min. in the commercial machine, to 40,000 revs. per min. in the laboratory centrifuge) conferred on it a power of separation and clarification far in advance of any other centrifugal machine in use to-day.

To secure this vastly increased speed of rotation without friction was the next problem confronting the designers, and this problem was overcome by arranging that the rotor should be both suspended and driven from the top, its lower end being entirely free to find its own axis. A seamless steel bowl, tubular in shape, was suspended by means of a flexible spindle with a cone at its upper end from a simple ball bearing. The cone rested on the balls. Just above the cone was the wheel, driven as a turbine by steam or air pressure. The entire weight of the revolving bowl was carried on this bearing—the only bearing in the machine. At the lower end of the bowl was a guide—the drag. Because of its nearly frictionless ball-bearing and light-weight bowl, a very small amount of oil and little power was required for the machine's operation. It followed that wear and tear and consequent repairs were reduced to a minimum. All wearing parts were so designed that they could be easily and cheaply replaced.

Secret of Successful Operation

The secret of the successful operation of the machine was the flexibility of the bowl spindle, the bearing, and the drag. These were designed so that they had no fixed position, but would automatically adjust themselves to the axis of the bowl, which, at high speed, must inevitably revolve round its own centre of gravity. This freedom in the action of the bowl reduced friction to a minimum, and with it the expense and trouble which friction caused. At the same time it guaranteed a smooth running bowl.

In operation the power was first applied and the bowl brought to its operating speed. There was a speed indicator by which the speed of the bowl was determined. The liquor to be treated was fed into the bowl bottom. This was equipped with wings which served to keep all parts of the liquid at the same speed of revolution as the bowl. The liquor was therefore instantly brought up to the speed of the bowl, and as a result formed a cylindrical wall against the shell of the bowl. When the bowl had filled to its outlet ports liquor discharged, as rapidly as it was introduced, passing continuously from the bottom to the top, through the discharge ports, and thence by gravity into suitable containers or pipe lines. The liquid while passing through the bowl was subjected to a centrifugal force of 16·950 times the force of gravity. Thus, the "apparent weight" of substances was increased 16·950 times, and the difference between the apparent weights of two substances, whether of a liquid or a solid or of two liquids, was magnified by a like amount.

This difference increased tremendously the rate and effectiveness of separation. As the liquid was passed through the bowl it assumed an apparent weight 16·950 times its specific gravity, or 16950. At the same time the suspended solid similarly assumed an apparent weight of 18645. Separation under such conditions was easily effected.

A very high force was desirable from two standpoints. In the first place, the higher the force the shorter might be the period of time required for centrifugal treatment. In other words, the greater the capacity of a machine in barrels per hour. In the second place, with a high force it was possible to secure sedimentation of very small particles that could not be moved by a lower force. It thus happened that a force of 18,000 times the force of gravity was sufficient to move any particle not too small to be seen under a microscope, and if the viscosity of the liquid was not too great, the smallest particles would move rapidly enough to make the operation practical. The higher force of 40,000 times gravity as exerted by the laboratory machine was of advantage, not because it would produce an optically clearer liquid, but because it would remove particles that were sub-microscopic.

Small diameter, in addition to being a requirement for high force, was of advantage in simplifying the perfect balancing of the rotor. Perfect balance was not only a mechanical necessity for a machine that was to be operated, perhaps continuously for many years, but it was also necessary to secure efficient results in the application of the force to liquids. In the super-centrifuge balance was safeguarded by maintaining relative flexibility at all points. The rotor was put as nearly as possible in balance, and then when in rotation the bowl was permitted to rotate about its own centre of gravity.

It has been found that apparently slight changes in the design of the rotor might be sufficient either to make an operation expensive and impractical, or to make the operation economical and successful. This was true not only of emulsion separation, where the designer was confronted with liquids of different specific gravities which must be separately discharged, but also of clarification procedures where suspended sediment was to be removed from a liquid.

Uses to which the Sharples Centrifuge may be Put

The following were some of the more common uses to which the machine had been put: (1) Slimy or gelatinous precipitates which tended to clog a filter could be removed as easily as granular or crystalline particles. (2) Suspensions of particles too small to be retained on filter paper could usually be handled. For example, a suspension of silver chloride that yielded a milky filtrate, could be completely cleared. A suspension that could be filtered clear only by means of a fine porcelain filter could also be handled. (3) Some suspensions could not be filtered because of the deleterious action of an acid or alkali on the filtration medium. The efficiency of the super-centrifuge was not impaired by corrosion. (4) Emulsions could not be separated by filtration (except under certain conditions not always practicable). The only methods of separation were gravity or centrifugal. Gravity might be too slow; it might not cause separation at all; and the time required for gravity separation might give rise to undesirable reactions, such as fermentation, evaporation, &c.

Two years ago centrifugal force was wholly unknown in the petroleum oil field. To-day more than 18,000 barrels of emulsion were handled per day by the super-centrifuge. It was estimated that approximately 6,000 barrels per day of good crude petroleum were being recovered by the super-centrifugal process. This oil was formerly completely lost. The crude petroleum emulsion mentioned above was of the type wherein oil was continuous with dispersed water globules. The opposite type of emulsion wherein water was continuous with oil as dispersed phase was found in the so-called soap stock formed in the caustic soda refining of vegetable oils. Two years ago the commercial centrifuge was unknown to the refiner of vegetable oils. To-day approximately 3,750 barrels

per day of soap-stock (principally from cotton seed oil) were being handled by the super-centrifuge. The computed daily recovery of edible oil from this soap-stock was 225,000 lb. This oil was formerly utilised as material for soap making, either by direct saponification of the oil in the soap-stock to form a crude soap, or by acidulation of the soap-stock, hydrolysis of the neutral oil contained, and distillation of fatty acids. The difference between the market value of the oil as soap material, and the oil as an edible product was enough to make this process highly profitable. It was computed that in the United States the refiners of cotton seed oil, peanut oil, &c., would reap a collective profit of more than a million dollars in 1920 by use of this super-centrifugal process.

Another case quite as interesting from the purely technical standpoint was that of varnish and lacquer clarification. Centrifugal force had been recognised during the past twenty years as possessing high value in the clarification of such a liquid as varnish. Crude centrifugal machines had been in successful use in the varnish manufacturing industry throughout this period, but it was not until a carefully worked out centrifugal process for varnish treatment was available that this use of centrifugal force came to be general practice. It was computed that more than $25,000 gallons of varnish and lacquer per day were subjected to a super-centrifugal treatment.

Industrial Oxygen Research in U.S.A.

As the result of a gift of $5,000 by the Research Corporation, of which Dr. Frederick G. Cottrell, Director of the Bureau of Mines, is the founder and Elon H. Hooker, the president, research work is to be undertaken by the Harvard Engineering School under the direction of Professor H. K. Davis, in the manufacture and industrial uses of oxygen. In consideration of its financial support, any patents ensuing from the research will become the property of the Research Corporation. Dr. Cottrell estimates the production of oxygen in the United States at 3,000,000 cubic ft., or about 130 tons, over 95 per cent. of which probably is used for cutting and welding purposes. The Linde Air Products Co., using the Linde process and operating about 50 liquefaction plants, and the Air Reduction Co., using chiefly the Claude process, produce about 75 per cent. of the oxygen consumed, which they compress in steel cylinders and distribute to the trade. The remaining 25 per cent. is obtained by electrolysis in several hundred privately owned installations producing gas for immediate industrial consumption in the plant.

At Muscle Shoals, Nitrate Plant No. 2, were installed 30 of the largest size Claude units primarily for the separation of nitrogen used in the production of cyanamide. If this installation, it is stated, were used for oxygen production, the daily output would about equal the total oxygen production noted above. The great economic importance of oxygen research and the value of increased knowledge of cheap and efficient methods of separation of this gas, particularly to the metallurgical industries, will be recognised by the fact that a single blast furnace with a daily production of 500 tons of pig iron requires to be blown into it for this yield, a volume of air containing five times the oxygen produced daily by present methods and resources.

Debentures

THE value attached to Mr. Herbert W. Jordan's book "Debentures: the Purposes they Serve and How They are Issued," is indicated by the fact that it has now reached its ninth edition. The book, which contains 65 pages, is divided into two parts. Part one deals with the uses to which debentures may be put, and Part II. explains the proceedings to be gone through when issuing debentures, and contains chapters on the transfer and transmission, the redemption and the re-issue of debentures, the appointment of a Receiver, &c. The whole subject is dealt with in such a clear and concise way that it can be readily understood by the uninitiated, in addition to being a useful text-book for the business man. The book may be obtained from Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.2, price 1s. 6d. net.

New Derbyshire Minerals

Brief reference was made in our issue last week to the discovery by Mr. C. S. Garnett in the Peak district of Derbyshire of several minerals not previously known to exist there. The following notes regarding the minerals have kindly been supplied by Mr. Garnett.

Zaratite: Nickel Ore

Samples of this mineral, of a pale emerald green colour, and usually containing a large quantity of hydrozincite, were recently found in old dumps of decomposed dolerite raised during the early working of a local mine driven in search of lead ore. When following up the search for further nickel, some nickeliferous hydrozincite (zinciferous zaratite) was found, which was of a blue colour instead of the pure green of zaratite. On analysis, this was found to contain COBALT, which probably existed as remingtonite, the accompanying zinc and nickel existing as their hydrous carbonates. The "mineral" is therefore probably a mixture of the three mineral species—hyrdozincite, zaratite and remingtonite.

Considerable difficulty attaches to the following up of such finds with a view to ascertaining the quantity available, as many of these mines are of considerable antiquity and dilapidation, having been driven in search of lead ore when little or nothing was known of the rarer metals.

Nephrite: Jade

Near the margin of a basalt quarry at Bonsall, a somewhat lenticular nodule-shaped lump of white nephrite was found.

Diabantite

Beautiful specimens of this uncommon member of the chlorite group of complex silicates were found at Mill Close Mine, Darley Dale, having been raised during the early working of the mine. It occurs in the much decomposed dolerite as radiated spherical aggregates (up to 2cm. diameter) and is of a dark green colour. It is usually associated with calcite in amygdaloidal cavities, has a specific gravity of 2·79, hardness of 2·3, and is strongly pleochroic.

Cimolite

A hydrous aluminium silicate. A thin bed of this mineral occurs near Hopton. It is quite white, amorphous and chalk-like.

Allophane

A hydrous aluminium silicate. Many of the numerous rake veins in the mountain limestone of the Middle Peak region are rich in forms of limonite, but chiefly the earthy variety—ochre. In one of these veins which is cut in the Coal Hills Quarry, near Wirksworth, allophane is to be found in more than one form. The commonest form is that of a light, amorphous powder; it also occurs as an opaque, white incrustation, and also as a translucent, subcrystalline incrustation of the faintest green tinge, due to the presence of a minute trace of malachite.

Utahite

The limestone shale in the vicinity of Wensley contains a quantity of an insoluble basic ferric sulphate as dull, yellowish-brown films in the shale. Its mode of occurrence renders its accurate analysis difficult, but it seems to be a variety of utahite.

Manganese Ore

Manganese is not a new discovery; the indefinite hydrous oxide (Wad) has long been known to exist in certain districts in the county. It has also been previously worked, but the present scarcity (recently mentioned in the House of Commons) led to the work of prospecting for a deposit to be mined on as large a scale as possible. This work has been successful, and arrangements are being made (by the company for whom the work was undertaken) for the mining of the ore.

Sulphur

"Native sulphur is said to have been found," is recorded by ancient writers, but no confirmation in recent years seems to have been made. A good specimen was recently found near Eyam. It is a greyish-yellow powder, burning readily when ignited.

A 20-ton plant is being constructed by the William Livingston Corporation for the PRODUCTION OF SODIUM SULPHITE from the deposits at Fusikier, Saskatchewan.

Government and Trade

Work of the Department of Overseas Trade

(From a Correspondent)

THE business community has never been particularly favourable to direct Government interference in commercial matters, and there is little doubt that at the present time it is even less disposed than formerly to welcome any attempt by the Government to get into direct touch with trade circles or to take any active steps in an endeavour to shape the future of British trade.

This attitude is, to-day, readily understandable, although it cannot be viewed as other than a mistaken one. During the five war years it became increasingly necessary, with the march of events, to exercise over practically all business matters a steadily lightening grip of control. Business men in all branches of industry were brought into constant and irritating contact with effects of Government influence; they were, in many respects, reduced to carrying out the orders of the Government quite irrespective of what might have been their own inclinations; their factories were diverted to the manufacture of goods in which the manufacturer had no personal interest and which were solely of war-time value. In short, to the normal business worries were added so many vexatious rules and regulations that the necessity for the war-time measures was completely obscured from view by the irritation caused. The experiences of this period have, therefore, resulted in a firm impression on the minds of the greater portion of the business world that for the Government to show interest in commercial matters is simply the herald of further trouble and annoyance to the commercial community. So deeply has this impression been ingrained that when viewing the question of the Government and trade, the balance is generally very unduly weighted against the Government, the many beneficial services which it renders and has rendered during past years being so familiar to the business man that they are seldom, if ever, thrown into the scales to counterbalance the purely temporary and abnormal restrictive measures during the war. No measure enacted during the war period could adversely affect the trade of the nation to anything like the extent which would be experienced if, for instance, the Government were to cease to exert itself in securing the safety of trade. It is due entirely to the forethought and activities of the Government that safety of trade has been secured at home, or, by international commercial treaties, overseas, without which trading would be a most precarious undertaking; the maintenance of communications, postal, telegraphic and telephonic, the many and various Government acts beneficial to the health and welfare of the worker, and, therefore, ultimately to the whole industry. These are but a few of the forms of Government interference, the beneficial effects of which cannot be refuted, but they serve to indicate some of the difficulties which would be experienced if the Government stood aloof from trade matters.

Necessity for Government Interest

There is, however, no intention on the part of the Government to relax interest in commercial matters. On the contrary, the necessity for Government interest—an interest which is constructive and helpful—was never more pressing than it is to-day. The many and radical changes which the war has caused in all the major overseas markets have considerably complicated overseas trade and rendered it a much more difficult business than it was before the war. Prior to the war, essential conditions in the various markets remained practically unchanged from year to year, or altered only slowly and along normal lines, rendering it a matter of little difficulty to follow the course of the market in which a trader may have been interested. The position is now, however, entirely changed in almost every respect; conditions of the industry at home are quite different to those obtaining formerly; normal business channels for obtaining information regarding overseas developments have been dislocated and the question of export trade generally is hedged with difficulties. In many markets trade has been either lost or materially cut into by competitors, while industry in this country has been concentrating on war work, and it will entail exceptionally strong and sustained effort on the part of merchants and manufacturers to overcome these difficulties and lift the United Kingdom once more to its former position in the world of commerce.

It is in this respect that the Government can, and does, render invaluable assistance to traders through one of its newest Departments—the Department of Overseas Trade. In its earliest stages, the Department, then known as the Commercial Intelligence Branch of the Board of Trade, was little more than a medium for the transmission to the business public of information emanating from other Government Departments or from the Consular and Trade Commissioner Services. Since that time, however, its functions and activities have been extended so largely that it is now well equipped and thoroughly efficient to undertake active duties for the assistance of traders. A brief review of the organisation and activities of the Department may serve to indicate the nature and extent of the assistance which it is in a position to render.

Overseas Intelligence System

One of the primary requirements of a trader desirous of entering into or developing overseas trade is a constant flow of reliable and up-to-date information concerning general and specific conditions ruling in the markets in which he may be interested. To secure information of this character, the Department has organised its Overseas Intelligence System. This organisation comprises not only the Consular Service, which has recently come under the control of the Department, but the Commercial Diplomatic Service in foreign countries, and the Trade Commissioner and Imperial Trade Correspondent services in the Dominions, Crown Colonies, Protectorates, &c. The ramifications of this intelligence service are of such a wide-spreading nature that there is no market of premier importance, and very few of lesser, which is not covered, in the case of foreign markets, by both Consular and Commercial Diplomatic officers, or in Empire countries by a Trade Commissioner. The duties of the Commercial Diplomatic officers and Trade Commissioners are devoted entirely to the interests of British trade in their respective spheres. Not only do they use their powers towards the improvement of the general conditions under which United Kingdom exporters must trade, and for this purpose keep in very close touch with the Government of the country in which they reside, but they also keep the Department fully informed of the commercial situation in general and of any specific openings for British trade. It is the aim of the Department, under whose active control all branches of the commercial intelligence system have been placed, constantly to improve the service in both numbers and efficiency, and the Department works in close conjunction with a body of business men in making appointments to these posts. Every endeavour is being made to ensure that the best men available are secured, and searching tests are made as to their suitability. Many improvements have already been inaugurated, and our intelligence service has been lifted to a supreme position amongst those of the world.

In order that the benefits to be derived from such an intelligence system should be made available with fullest advantages to the business community, it is necessary that the headquarters should be so organised and staffed as to be able to deal efficiently, and with discrimination, with the information received, and at the same time it is imperative that, in order to fulfil its functions adequately, it should be fully cognisant with the march of events in home industry. In order to achieve this end, the Department has been divided into four main divisions—viz., the Foreign, Empire, Trades and General Divisions.

Foreign and Empire Divisions

The Foreign Division is that more closely in touch with the overseas services in foreign countries, and is subdivided into geographical sections and sub-sections dealing with respective countries, each section and sub-section being, so far as possible (and exceptions are rare), in charge of officers who have had actual experience in the countries with which they are now dealing. The Empire Division is the Empire counterpart of the Overseas Division, and is similarly subdivided and staffed to deal with Empire countries, &c.

Trades Division

The Trades Division is that portion of the Department which is in close touch with home industries, and it also is subdivided into sections and sub-sections, which deal with a specific trade or group of allied trades, and are staffed by officers who have had actual business experience in the trade with which they are dealing, who continue in close personal contact with the trade. By the close co-operation which exists between the Foreign and Empire Divisions on the one hand, and Trades Division on the other, it is possible to assess the value of information received and to decide upon the best uses to be made of it. Overseas political developments may frequently have possible effects upon British trade interests, and by this close interworking these are adjusted to their proper perspective to commercial interests, and the Department is thus enabled to bring before other Government Departments, whose activities are political, the trade point of view when political matters affecting commercial interests are in question.

General Division

The General Division is of a somewhat composite character, and includes amongst its duties the dissemination of such information as may be considered of interest to traders. Further sections are the banking, shipping, tariff and statistical sections, &c., a group of sections whose interests and duties are indicated by their names.

It will thus be seen that the Department is in a position to be of the greatest assistance to traders in placing before them a vast quantity of reliable and recent information. In fact, it has already available, or can readily obtain, general or specific information of any nature which is helpful and of interest to British traders. The following few examples of the character of information available may be of interest. Information is constantly distributed concerning foreign or Colonial contracts open to tender; overseas demand for particular lines of goods; general or specific conditions obtaining in overseas markets, including best methods of marketing and distribution, credit conditions, terms of payment, nature of competition, and best methods of meeting it, &c., customs tariffs and regulations; regulations governing commercial travellers; registration of trade marks, consular invoices, &c., statistics of imports and exports, shipping and transport, &c. Lists are also available of names of importers of specific lines of goods in overseas markets, or of individuals or firms considered suitable agents for British manufacturers, &c.

Industries Fairs and Trade Missions

The supplying of information represents, however, only one section of the activities of the Department. There are, in addition, various other and more constructive activities which the Department is constantly undertaking. Of these may be mentioned the well-known British Industries Fairs held in London, Birmingham and Glasgow, which have already established themselves among the premier industrial fairs of the world, while there are further activities of fully equal importance which are less well-known, such as the special investigation of overseas markets. In these cases the Department co-operates with trade associations, and undertakes the organisation of expert missions to investigate any overseas market or group of markets in which the trade may be interested. Further, the department undertakes a half share in the financial responsibility, and assists the mission, so far as possible, in its official capacity in smoothing out any difficulties met in the course of its investigations. Several such missions have already been despatched, and while some are still in progress, others have been completed, and have resulted in the acquirement of much invaluable information. As an indication of the appreciation of these missions, it may be stated that of the additional suggested investigations now under consideration, several have been proposed by trade associations which have already participated, and have had actual experience of the benefits derived from such missions.

Co-operation Between Traders and the Department

The Department is, however, desirous of continually and effectively increasing its powers of assistance to traders, and it is fully recognised that the best method of doing so is to attain as high a degree as possible of co-operation between traders and the Department. For this purpose arrangements have been made whereby Trade Officers of the Department visit at regular intervals the Chambers of Commerce of the principal industrial centres where they remain for a week meeting the business men of the district, rendering assistance or receiving suggestions as to the manner in which the Department can best serve the ends of the industries represented. The views gathered and suggestions received are, on return, placed before the Department, when they receive close and careful attention, and are considered, so far as practicable, as guides to the future policy of the Department. Despite the brief period during which this scheme has been in progress, it has already given abundant evidence of having accomplished much good and of having drawn the Department and the commercial community into close and cordial relation. For a similar purpose, overseas officers returning to this country on leave are visiting the principal industrial centres, and placing before business men first-hand information concerning the conditions ruling in their respective countries.

It will thus be evident that the Department of Overseas Trade is something completely novel in Government Departments. Its interests are entirely commercial, and yet it exercises no form of control over business men; it issues no acts or regulations of any sort to the commercial community, nor does it desire to dictate to traders as to the methods they should adopt in carrying on their businesses. Its sole aim is to render every possible assistance towards the expansion of British trade overseas. Any British business man, whether merchant or manufacturer, who applies to the Department is assured of receiving all available information or other form of assistance which the Department is capable of rendering. The policy of the Department, administered wisely and with discrimination, is thus shown to be one to which no business man can take exception, and may briefly be stated as a desire to co-operate closely and cordially with the commercial community in an endeavour to do all in its power to foster and facilitate British trade overseas.

Titanium Oxide for Paint

Some New Developments

THE advantages of titanium oxide as a paint material have long been known in this country, but progress in its manufacture was hindered by the war and by the difficulty of obtaining sufficient supplies of suitable raw material. This comparatively new paint material has been manufactured in Norway during the past few years, and the factory chiefly engaged therein is contemplating extensions. It is claimed by the Norwegian makers that the advantages of titanium oxide in the direction of economy and durability are such that it will ultimately supersede lead and zinc, but this is certainly an exaggeration. The manufacture is being taken up in America by the Titanium Products Company at Niagara Falls, under the control of the National Lead Co. This firm does not anticipate that it will take the place of lead and zinc, but for certain purposes it should prove an invaluable paint. Titanium is distributed fairly commonly throughout the world, generally in combination with iron or other metal, and in a form not readily separable. Suitable deposits for the manufacture of paint, however, are said to exist in the U.S.A., some of which are controlled by the Titanium Products Co. For the extensive manufacture and use of this product improvements in the methods of production of the necessary raw material, *i.e.*, the separation of titanium oxide from its ores, are very desirable.

THE NATIONAL ASSOCIATION OF MERCHANTS AND MANUFACTURERS is convening a conference to be held in the Cannon Street Hotel on Thursday, Sept. 30, to consider the cost of living. In arranging the conference the association, whose policy is to resist State interference with trade, has in mind the campaign which the Labour organisations are to carry out this autumn. The conference will demand retrenchment in public expenditure and a return to administrative economy and thrift. It will protest against unnecessary continuance of bureaucratic control and State interference in trade and industry, and the consequent stifling of private enterprise and encouragement of slackness, inefficiency and corruption. It will declare that a policy of freedom in its widest sense in all matters relating to trade and commerce is the basis for developing the resources of this country, increasing wealth, diffusing prosperity, and securing a large revenue.

The Institution of Mining Engineers

Annual Meeting at Manchester

THE thirty-first annual general meeting of the Institution of Mining Engineers was held at the Town Hall, Manchester, on Wednesday, September 15, under the presidency of Colonel W. C. Blackett, C.B.E., the President of the Institution.

The medal of the Institution for 1919-20 was awarded to Dr. John Bell Simpson, who was prevented by indisposition from attending the meeting, and it was received on his behalf by his son, Colonel Simpson.

The President stated that the paper by Mr. Ernest Berry on "The Froth Flotation Processes" as applied to the treatment of coal would not be given at the present meeting.

The Better Utilisation of Coking Slack

A joint paper on this subject by Mr. A. E. Beet and Mr. A. E. Findley, was read by the latter who said that on a former occasion in the discussion on Messrs. Blyth and O'Shea's paper on "The Examination of Coal in relation to Coal Washing," he emphasised the fact that certain coals, which could not by washing be rendered low enough in sulphur and ash to give a coke suitable for metallurgical purposes, should not be allowed to go to the ovens. The object of the present paper was to suggest means to prevent that and to utilise the material to the best advantage. The fraction of a coal sample which floated in a solution of a specific gravity of 1·30 was a more or less pure material containing from about 0·8 up to about 2·5 per cent. of ash and of 0·7 to about 1·8 per cent. of sulphur, whilst the coal which floated in a 1·40 specific gravity solution contained the whole of the pure material and quantities (usually large) of coal containing from 7 to 10 per cent. of ash. In the main this second type of coal was a homogeneous substance as distinguished from coal with particles of dirt attached. Dr. Marie Stopes had shown that the banded bituminous coals contained at least four distinct varieties of coaly material, namely, clarain, vitrain, durain and fusain. Clarain and vitrain were bright coals having specific quantities of 1·28 and 1·29 respectively; durain was dull and hard, and had a specific gravity of 1·395; fusain was a soft, dull fibrous material. The specific gravities of the various constituents appeared to be open to question. Very likely—certainly in the case of durain—the specific gravity varied with the ash content which, judging from the results given by Rudolf Lessing (*Journal Chem. Soc.*, 1920, p. 247) appeared to be very variable. It was also well known that pieces of clean coal often had a less specific gravity than 1·28. In the experience of the authors the lowest was 1·24, and this was a dull hard constituent; the brighter portions had a specific gravity of about 1·27. Hence it was quite possible that almost ash-free durain existed. The fact that the ash of a constituent might affect its specific gravity would influence the proportion of clarain, vitrain and durain occurring in a fraction which floated in a 1·40 specific gravity solution. Moreover, a particle which sank in a 1·30 solution might contain anything from 15 up to 100 per cent. of durain; for example, 50 per cent. of clarain or vitrain with a specific gravity of 1·285 and 50 per cent. of durain with a specific gravity of 1·395, the mean being 1·34. It was by no means unlikely, therefore, that in washing 1 in. or ½ in. slack, 30 per cent., or even more, of the clarain and vitrain would be mixed with the durain, and only finer crushing and further washing would separate the constituents. With a good washer it should be quite easy in the case of normal coals to separate the clarain and vitrain from the durain which would be contaminated with varying percentages of clarain and vitrain. Fusain could be left out of the question as the quantity was usually small. The ash of clarain and vitrain was only about 1 to 1½ per cent., that of durain from 5 to 7 per cent.

Separation of Coals in Liquids of Different Specific Varieties

It was decided to try the separation of coals in liquids of different specific gravities, the idea being to separate the best of the coal for coke making and to collect the inferior fuel (not including dirt) with the object of submitting it to low temperature distillation for the formation of fuel oils and a smokeless fuel in the nature of coalite. For coking properties the constituents named were placed in the following order: clarain, vitrain, durain and fusain. The characteristic non-swelling of durain on coking was a good property for a coal which was to be used in low temperature carbonisation, as one of the main troubles in that process was the swelling of the coal at the temperature of carbonisation with the consequent sticking and holding up of the charge in the oven or retort in the form of a viscid mass of semi-decomposed agglutinatious material. If a portion of coal was obtained which showed only feeble signs of swelling on coking they had achieved much in dealing with low temperature carbonisation. The presence of smaller amounts of swelling coal would probably add a sufficiency of coking properties to enable a not too friable coalite to be produced.

With these ideas in mind, the authors experimented with four ordinary coking coals worked in the neighbourhood of Sheffield, and a shale from Derbyshire for comparison. The coals were separated into fractions by the use of alcohol-chloroform mixtures, giving—

(*a*) Whole sample; (*b*) Floatings in 1·30 specific gravity; (*c*) Sinkings in 1·30 specific gravity; (*d*) Floatings in 1·48 specific gravity; (*e*) Sinkings in 1·48 specific gravity.

The low-temperature carbonisation was carried out in hard glass tubes, closed at one end, 60 cm. long, 13 mm. in bore with a wall thickness of 2mm. Fifteen grammes of coal were used, which were retained by a porous iron-gauze-asbestos plug; this was followed by a 10-cm. column of ignited firebrick broken to the size of peas, and another plug. Near the open end of the tube, 15 cm. of dry cotton-wool, maintained at 100°C., served to retain the heavy oils. The distillation was carried out, under a reduced pressure of 15 in. of mercury, in an electric tube furnace at 600°C. The firebrick was first heated, the closed end of the tube, with the coal, projecting from the furnace; by moving the latter axially the heating was extended gradually to the closed end of the tube.

The escaping gases passed through—

1. A separator, where most of the light oils and ammoniacal liquor condensed, and were measured.
2. Two bulbs of 10 per cent. sulphuric acid, to absorb the rest of the ammonia.
3. An unweighed calcium-chloride tube.
4. A bulb of creosote oil (with an exit calcium-chloride tube) to absorb the rest of the light oil.
5. A guard-tube of calcium chloride.

The following example shows the details of the calculations:—

	Grammes.
Weight of empty combustion-tube	127·86
,, tube and fuel	142·86
,, tube, fuel, firebrick, and plugs... ...	158·92
,, firebrick and plugs	16·06
,, cotton-wool, directly weighed	1·33
,, tube, fuel, firebrick, and cotton-wool...	160·29
,, cotton-wool (indirect)	1·37
Average weight of cotton-wool	1·35
The distillation took from 10·15 a.m. to 1.20 p.m. =3 hours 5 minutes.	
Weight of tube, coalite, firebrick, cotton-wool, and oil	156·85
Loss in weight due to volatile matter, less heavy oil	3·44
Weight of oil-piece of the tube	64·93
,, coke-piece of the tube	91·92
,, empty oil-piece	62·80
,, heavy oil and cotton-wool	2·13
Now cotton-wool weighed	1·35
Weight of heavy oil	0·78
,, ,, per ton, in pounds	116·5
Heavy oil: Taking the specific gravity of the oil as unity, the volume per ton, in gallons, is ...	11·7

There were 1·8 cubic centimetres of ammoniacal liquor and 0·3 cubic centimetres of lighter oil in the condenser. The ammonia was estimated by the distillation of the liquor and the contents of the acid. The light oils absorbed by the creosote were estimated by direct weighing.

Conclusions

The following conclusions were drawn from the investigation. It is possible to separate any coking slack into two or more fractions, as under:—

1. An almost ash-and-sulphur-free coal for the production of a superior coke to be used in metallurgical practice—that is

blast-furnace and crucible coke especially. This fraction varies from 55 to 76 per cent. of the whole sample, and for coking slacks will not be far removed from 60 per cent. The high-temperature coke yielded on carbonisation of this material would contain about 3 per cent. of ash and generally well under 1 per cent. of sulphur.

2. A homogeneous coaly substance admirably suited for low-temperature distillation in a suitable vertical retort (say, of the Glover-West type), yielding a coalite considerably less friable than anything obtainable from non-coking coal and having little tendency to stick in the retort. The weight of this fraction varies from 17 to 34 per cent. of the weight of coking slack, and it would yield a coalite containing from 7 to 12 per cent. of ash and enough volatile matter (6 to 10 per cent.) to render it easily ignitable; and, in addition, 20 to 25 gallons per ton of oils resembling mineral oils, from 11 lb. to 15 lb. of sulphate of ammonia, and 7,000 cubic feet of a rich gas per ton, from which, by steaming, one could reasonably expect a yield of from 30 lb. to 50 lb. of sulphate of ammonia, and from 12,000 to 15,000 cubic feet of a poorer gas of about 500 B.T.U. per cubic foot.

3. A fraction of the whole weight of unwashed material, usually about 20 to 46 per cent. by weight, which contains from 55 to 60 per cent. of coal and from 45 to 40 per cent. of dirt, which may be taken to ash in a suitable retort (a similar one to a shale retort), yielding a low-grade gas as the main product, with oils similar to mineral oils and ammonium sulphate as by-products.

In using this method of separation, the results expected from each fraction are as follows:—

(*a*) The yields of all products would be slightly increased on present coking practice, better gas would be made, a metallurgical coke with a much lower percentage of ash and sulphur and a consequently higher calorific power would result, and the scrubbing for the light oils would be rendered more efficient because there would be a lower percentage of diluents in the gas.

(*b*) The coalite would be the main product. The labour costs and troubles in the working of the plant would be enormously reduced. The yields of ammonia, oils, and gas would not be, if at all, very appreciably affected; furthermore, the main product would be a saleable one, probably at a price very little below that of the coal from which it was prepared.

(*c*) There would be only ashes to be disposed of, thus preventing the spontaneous combustion of inflammable pit-heaps. The yield of oils would be very appreciably increased, whilst that of sulphate of ammonia would be nearly doubled. A market would, of course, have to be found for the low-grade power gas produced in this process, as it is the main product.

The establishment of a central electric power station would find an outlet for this gas and enable the company to make an ample profit whilst selling at a very low figure.

The advantages to be claimed for running low-temperature alongside with high-temperature carbonisation are numerous:

1. Trials can be made at minimum cost.
2. Gas, steam and washers are handy.
3. Labourers are accustomed to the same class of work.
4. One manager could control both plants.
5. Reduced costs in handling and transport, &c.

Discussion

Dr. WHEELER asked whether it was really practicable to separate the bright bands from the dull bands so as to make them separately utilisable. In that connection he regretted that Mr. Bury's paper on "The Froth Flotation Processes" would not come before the meeting because he thought it would have been found that Mr. Bury proceeded upon similar lines to those followed by Mr. Findley, and that the separation of the bright comparatively ashless coal from the dull high ash-content coal could be effected by the froth flotation process. Mr. Bury would, therefore, have answered the question It was clear that Mr. Findley had put forward a very valuable suggestion particularly with regard to those collieries which were associated with coke-oven plant and had difficulties in dealing with some of the poorer parts of the seams.

Professor Sir JOHN CADMAN said matters of this character might appear at the moment to be academic and of no real practical value, but the paper recorded a very important piece of work, and the authors showed a great sense of proportion in putting their fingers upon a definite trade process which had been tried and made a commercial success. Certainly in connection with the distillation of shale, as a distillation machine, it was a success. At the moment the country was passing through an extraordinary phase in the use of fuel. The war had shown that coal in its present form could no longer hold its own for power purposes. The mercantile marine, certainly naval marine, was tending to run entirely upon liquid fuel, and it would become necessary to use coal in a liquid or gaseous form. Therefore, they would be forced before long to consider the utilisation and rearrangement of coal so as to be able to apply it in that form. Certain universities had already taken time by the forelock in this matter, and he congratulated the University of Leeds upon having secured Dr. Wheeler to take the Chair of Fuel. Great Britain must move in the production of liquid fuel, and it could only be done by very definite scientific investigation. It might come by a process of trial and error, but in the long run success would be obtained by hard work in the examination of the component parts of these products. The authors had gone on lines which would give much useful information to those who had to deal with these mining problems.

In replying to the discussion, Mr. FINDLEY said the method of putting the material through a Scotch shale retort had been tried, but not under the conditions he advocated. The clarain and vitrain were left in, and the consequence was that at the top of the retort they got a swelling mass, and pokers had to be used to get it to drop. When it did drop off they had to use longer pokers because it was hanging up further down. Some big firms had tried the method, and he had hoped that Mr. Winter Blyth would have been present to give an account of his practical experience in the matter. But in that case the vitrain was left in with the durain and he (Mr. Findlay) objected to such a method because the stuff could not be put through any sort of retort, and it led to no end of trouble. He went one step further. He had been on the plants and knew something about the working of them, and he also knew the types of coal which caused the hanging up. When he read about the work done by Dr. Marie Stopes it put him on to the track of something which might be useful; he then took the gravities of these different types of bands. By that time Lessing had published his work and he thought by combining those things they could get on to practical lines; and that led to his giving this paper.

Carbon Monoxide in Coalmines

Mr. J. Ivor Graham, chief chemist at the Doncaster Coalowners' Laboratory, read a paper upon the results of investigations into the carbon monoxide content in the main returns of coal pits in different parts of the Kingdom. He said he employed a portable apparatus, described in the *Journal of the Society of Chemical Industry*, 1919, vol. 38, page 10. In calculating the figures it was assumed that all the nitrogen present in the sample was originally mixed with oxygen as fresh air. The amount of oxygen originally mixed with this nitrogen could be easily calculated, and the difference between the latter and the percentage of oxygen found by analysis gave the percentage of oxygen absorbed. The carbon dioxide production was equal to the analytical figure minus 0·03 per cent. (the amount normally present in fresh air) and the actual analytical result for the carbon monoxide was taken as the production of this compound. For example:—

	per cent.
Carbon dioxide	0·18
Carbon monoxide	0·003
Combustible gas	0·32
Oxygen	20·28
Nitrogen...	79·22

79·22 volumes of nitrogen were originally mixed with 20·97 volumes of oxygen.

Oxygen absorbed = 20·97—20·28 = 0·69
Carbon dioxide produced = 0·18—0·03 = 0·15
Carbon monoxide = 0·003

The carbon dioxide production expressed as a percentage of oxygen absorbed = (0·15 ÷ 0·69) × 100 = 22.

The carbon monoxide production expressed as a percentage of oxygen absorbed = (0·003 ÷ 0·69) × 100 = 0·4.

The carbon monoxide production expressed as a percentage of carbon dioxide production = (0·003 ÷ 0·15) × 100 = 2.

In different pits the normal production of carbon monoxide, expressed as a percentage of the oxygen absorbed, varied

quite decidedly. For South Yorkshire (pits A and B) it varied between 0·7 and 1·0. When it was slightly higher contamination by air from heating or incipent heating was usually found to be the cause. In pit C (Lancashire) the results showed in a marked way the vitiation and increasing carbon monoxide of the air as it went round the workings. In pit D (Lancashire) the deepest workings were over 1,000 feet below those in pit C; the natural strata and air temperature were correspondingly higher, and the figures showed a slightly greater carbon monoxide production; in both cases, however, it was of the low order of 0·5 per cent. of the oxygen absorbed. The results from pits E and F (Fifeshire) showed a large proportion of carbon dioxide, and an almost entire absence of carbon monoxide. The conditions underground were very favourable for fungoid growth, especially the returns, which were warm and moist; decay of timber was consequently very rapid, and the proportion of carbon dioxide produced under such conditions would become considerable. The almost entire absence of carbon monoxide was not so readily intelligible, since it seemed probable that there would have been a certain proportion of "blackdamp" resulting from coal oxidation, mixed with the products of timber decay.

Staffordshire Pit Results

A Staffordshire pit (I) yielded a very interesting series of results, because distinct variations papeared for the normals from the different seams. In three seams the figure was under 0·5 per cent., whilst for the Ragman seam and one detected in the Cockshead seam the figure varied from 0·8 to over 2·0 per cent. Analyses of the return air in the Ragman seam were made on several different dates. Between March and May the carbon monoxide production increased, but afterwards a decrease became apparent, though, as far as could be ascertained, the conditions as regarded oxidation were as usual. He believed the higher figure showed some abnormality; for example, a greater proportion of fresh air through old workings would explain the analytical results. The figures for the same seam at another pit (H), worked under practically identical conditions at the same depth, showed that the carbon monoxide was between 0·7 and 1·0 per cent. of the oxygen absorbed. In this seam owing to the bad roof above the coal, a certain amount of top coal had to be left in the goaf. A certain amount of oxidation of this would take place in the gob, and most probably at a higher temperature than that of the strata. In other cases where the normal carbon monoxide production appeared to be on a high scale, as in South Yorkshire, the same necessity for leaving the top coal existed. On the other hand, in the case of the Two Yard, Mossfield, and Hollylane seams (pit I), where the normal carbon monoxide production was low, very little coal was left in the gob. The explanation of the almost negligible production of carbon monoxide in certain samples of intake air, where there was quite an appreciable difference in oxygen, and also in the return from shallow workings, was not quite clear. In both such cases the temperature would be comparatively low and possibly under such conditions coal oxidation was not the predominating factor in the vitiation of the air.

Experiments had been carried out on Barnsley soft coal by analysing the air after passing over the powdered coal at temperatures of 20° and 30° Cent. Similar experiments were carried out on a seam of coal from Houldsworth Colliery, Ayrshire: in one the coal had been exposed to the oxidising action of air at temperatures between 15° and 30° Cent. for nearly two years. The results showed very clearly the increase in carbon monoxide production, (*a*) with rise of temperature and (*b*) with length of exposure to air. It was quite evident that with the absorption of oxygen by the readily-oxidable constituents of coal, there was, as time went on, a gradually increasing tendency for the products of oxidation to decompose into carbon dioxide and carbon monoxide. Herein might also be a partial explanation of the relatively high carbon monoxide content in the return air of some pits where there was lying about a large amount of old coal dust. It might be suggested that the variation in the carbon monoxide production was partly due to this compound being given off with the firedamp or other gases normally given off during the winning of the coal. He had however, never found any appreciable quantity of carbon monoxide in any sample of pure "Firedamp" examined. For example, the sample from the Dunsil seam, South Yorkshire, showed less than 0·001 per cent. of carbon monoxide with 98 per cent. of methane present. The influence of temperature had been referred to. Some years ago in a paper before the Institution (*Transactions*, 1914-15, vol. 48, p. 521) he gave figures showing the connection between oxygen absorption and carbon monoxide production during the fresh oxidation of different portions of the Barnsley seam at temperatures between 70° and 140° Cent. These, together with the results detailed in the present paper, might be tabulated together, as follows, showing the effect of temperature on carbon monoxide production:—

Temperature. Degrees Cent.		Carbon monoxide production as a percentage of oxygen absorbed. Per cent.
20	.....	0·7
30	.....	1·0
70	.....	2·0
100	.....	2·8
120	.....	5·0
140	.....	7·0

General Conclusions

The general conclusions which he desired to bring before the members of the Institution were:—

1. Carbon monoxide is normally found in the return air of pits of over 500 yards depth, in quantities varying from 0·3 to 1·5 per cent. of the oxygen absorbed.

2. This carbon monoxide is produced as a result of oxidation of carbonaceous material at the coal face, in the gates, and in the goaf.

3. The higher carbon monoxide production of some pits is usually found to coexist with the presence of old extensive workings and/or when a considerable amount of coal is left behind in the goaf.

4. The application of the estimation of small quantities of carbon monoxide in the mine air will prove of considerable help in the detection and investigation of underground heatings.

Discussion

In a written communication Dr. J. S. Haldane said Mr. Graham's paper was of high importance for the light it threw upon the impurities of mine air and their sources by means of a comparatively simple and extremely delicate method. Mr. Graham had shown not only that CO was a normal constituent of the return air of coal mines, but also that the ratio of CO produced to oxygen absorbed gave very valuable information as to the source of the impurities in mine air. When the ratio was low they could now be sure that the disappearance of oxygen was due not to the oxidation of coal but to the oxidation of something else such as pit timber or perhaps iron pyrites. On the other hand, the ratio produced 1 per cent. The oxidation was of coal at an ordinary temperature with no abnormal heating. Lastly, when the ratio was much over 1 per cent. they could be pretty sure there was heating. By means of Mr. Graham's apparatus they could track down the source of heating if it had not been already discovered by the sense of smell. The investigation solved what had long been a mystery to him (Dr. Haldane). Experimenting with coal which had never been heated he found, in 1898, that about 0·2 per cent. of CO was present in the gas which remained after all the oxidation had been absorbed by coal, also that CO was proved parallel with the absorption of oxygen. At the time he assumed that the pure black damp of coal mines was simply the gas remaining after the coal or the substance present in it had absorbed all the oxygen, but in various samples of natural black damp which he examined, by a far rougher method than Mr. Graham's, he could find no CO, although, on the theory which he then held, it ought to have been present in early recognisable amounts. There were good "fat" samples of black damp from comparatively shallow pits, containing about 15 per cent. of CO_2, and it was evident now that the oxidation of coal was not the main source of this black damp, but probably the oxidation of timber by micro organisms. The physiological effects of the small proportion of CO which Mr. Graham had demonstrated in normal mine air were practically negligible. When, however, there was a considerable drop of the oxygen percentage, and this drop was due entirely to oxidation of coal, as in ship bunkers with imperfect ventilation, the effective CO might be very marked, and might make continuous work by coal trimmers impossible. A case of this kind in a war vessel came under his notice, and Sir William Atkinson also came across a case

underground. With the oxygen down to about 15 per cent. from the oxidation of coal alone the percentage of CO would rise to about 0·03, and this in the presence of the lowered oxygen would suffice to saturate the hæmoglobin of the blood to fully 40 per cent. with CO, and would cause more or less complete disablement for work followed by violent headaches and sickness. For tracking down incipient gob fires he believed Mr. Graham's method would be valuable, if indeed in the face of the extraordinary new regulation which had just been imposed in the coal industry any manager would care to look for gob fires till smoke and flame appeared. Mr. Graham's method was probably inferior in delicacy to the sense of smell, but the sense of smell became very quickly dulled in an odoriferous atmosphere, and it might be unreliable from other causes, as, for instance, the absorption of the odoriferous substances during the passage through finely divided coal. An army box respirator might be a help in tracking down heatings. The charcoal in the respirator absorbed the odoriferous substances, and meanwhile the normal sense of smell was restored so that on taking off the respirator the smell of a gob heating would probably be recognised again with ease. Perhaps some day they would be able to train gob fire bloodhounds, pointers, or setters to find incipent heatings.

Sir HENRY HALL said he was very pleased to see so much interest taken in what used to be considered as smell mixtures which few people took notice of, but the men in the mine did not need anything more than they already had for testing these things. By careful examination with a lamp they could be detected. All the miners wanted for the purpose of pointing out the dangerous parts of the mine was fulfilled by the ordinary safety lamp.

Professor HENRY LOUIS suggested that Mr. Graham should state in the table the quantity of air circulating in the returns where the tests were made. Presumably he took the obvious precaution of eliminating every other gas that would react with iodine pentoxide. Unless that was done there was a possibility of error. The only other point was whether the assumption was well founded that the nitrogen present in the sample was originally mixed with the oxygen in the proportions of fresh air. It appeared to him that nitrogen could be derived from firedamp. The occluded gases given off from coal certainly contained a far higher proportion of nitrogen than ordinary air.

Captain SINNETT, speaking from 10 years experience of the determination of carbon monoxide in vitiated air from various sources (but not from mine air), said the carrying out of these tests was a difficult matter. Unless it was done by an expert chemist false results might be obtained, and this might be extremely dangerous when dealing with such a gas as carbon monoxide, even in very minute quantities. In his opinion it was very difficult to remove some of the gases which might affect the iodine pentoxide. It was quite possible such gases might be present in mine air in very minute quantities and be recorded as carbon monoxide.

Author's Reply

Mr. GRAHAM, in reply, said he examined a number of samples of firedamp, and in all he had not found more than 3 per cent. of nitrogen and 2 per cent. of CO, the remainder being combustible gas, methane, with traces of very small quantities of the higher hydrocarbons. He had tested by using pure fire damp in the apparatus and getting a perfectly blank result, and then adding carbon monoxide to that mixture and getting the theoretical result for the carbon monoxide. The nitrogen present was insufficient in quantity to affect the calculation. Unfortunately he had not had time to complete the investigation. Passing the gas over a bromide solution seemed to be very effective in removing other gases which were likely to be met in coal mines. He examined return air, passing the gas through the bromide solution, and then also without using the bromide solution, and got identical results. In the Yorkshire pits which he tested the quantity of air was something like 20,000 cubic feet. The pits were well ventilated and showed small quantities of carbon monoxide. Very probably the sense of smell was much more reliable for the detection of heating because it was a very delicate thing, but under certain conditions small traces of carbon monoxide might be coming into the air with the odiferous constituents completely absent. They might have the gases from heating passing over a lot of small coal, and the higher hydrocarbons would be completely absorbed, but the methane (which when pure was odourless) and the carbon monoxide would come, although one might not be able to smell anything, whereas a reaction would be got with iodine pentoxide.

The "Oldham" Electric Safety Lamp

A paper with this title was read at the meeting of the Institution on June 10 last, and was now open for further discussion. In a written communication Mr. David C. Gemmell stated that at the colliery he was connected with two types of electric heat lamps which had been tested, one being the Oldham and the other an American lamp constructed on the same principle, the difference being in details of construction. The trial was too short in duration to allow him to pass an opinion upon the respective merits. In his opinion the head lamp was an improvement in the lighting of the mines and would be of great advantage in certain classes of work. Ability to work with a cap lamp had to be acquired, and in this respect the Scotch miner started with a considerable handicap. The electric cap lamp would be of little use to the miner working at the coal face, except perhaps in machine face stripping, but in timbering, haulage, coal-cutting and general on-cost work it should be extremely useful. Mr. Gemmell made several suggestions for improvements in details.

Mr. OLDHAM said since the paper was discussed they had been redesigning the lamp particularly on the lines of the suggestions then put forward, and he thought the new design would embody the recommendations made by Mr. Gemmell. They had also carried out a test which he thought answered one of the criticisms put forward at the last meeting with regard to the possibility of sparking.

Company News

MALAYAN TIN DREDGING.—An interim dividend has been declared of 1s. per share (less tax), payable on September 28.

VENESTA, LTD.—A dividend has been declared at the rate of 6 per cent. per annum, less tax, on the preference capital for the past six months, payable on September 30.

ANGLO-CONTINENTAL GUANO WORKS.—An interim dividend has been declared at the rate of 12½ per cent. per annum (1½d. or ¾d. per share), less tax, on ordinary for the half-year, payable October 1. Last year the dividend was the same.

UNITED INDIGO & CHEMICAL.—A dividend has been declared of 12½ per cent. for the year ended June 30, 1920; also a further dividend of 7½ per cent. on the preference shares, making 12½ per cent. for the year.

ASBESTOS CORPORATION OF CANADA.—A quarterly dividend has been declared on the preferred shares of 1¾ per cent., and on the common shares of 1½ per cent., payable on October 15. A year ago the dividends were 1½ per cent. and 1¼ per cent. respectively.

WEBB'S CRYSTAL GLASS.—Preference shareholders were invited this week to exchange each share held for 1½ ordinary shares in British Glass Industries, Ltd. Every holder of ordinary shares in Webb's Crystal Glass Co. was offered one ordinary share in British Glass Industries in respect of each two ordinary shares in Webb's Crystal Glass Co. It was stated that while the proposal was attractive to the shareholders in Webb's Company, it was not without benefit to British Glass Industries, which should derive considerable advantage through the pre-war standing of Webb's Company.

ELLIOTT'S METAL CO.—Mr. Neville Chamberlain, M.P., speaking at the annual meeting of Elliott's Metal Co. at Birmingham on Monday, said that industry was about to enter on a very critical, if not a dangerous, period. The limit of prices had been reached. It showed itself in the general shrinkage of orders. He was not of the opinion that demand had been satisfied. Demand would spring up again, but it would be for goods at lower prices. In the loss which would occur all would be concerned, not labour only. There would be less profits as well as less wages.

Mr. F. C. FAIRHOLME, chairman of the Associated British Manufacturers (Near East), Ltd., has been elected a director of the Neuchatel Asphalte Co.

From Week to Week

The death is announced of Mr. J. R. BURTON, for over 20 years in the employ of H. Richardson & Co., chemical manufacturers, Clementhorpe.

On and after September 29 the address of the INSTITUTION OF GAS ENGINEERS will be 36, Grosvenor Gardens, Westminster, S.W.1.

THE PLANT AND GENERAL AGENCY has removed from Winchester House to 4, Buckingham Gate, London, S.W.1. (Telephone: Victoria 6866, 6865 and 5117.)

Thirty men were killed and many scores wounded recently by an EXPLOSION OF 6,000 BOXES OF DYNAMITE on board some barges in Callao Bay. The disaster, it is stated, was caused by negligence in handling the explosives, and the damage is estimated at £50,000.

BRAZILIAN COAL is declared by a New York expert to be of the finest quality, examination showing each ton to contain 30 per cent. stone, 8 per cent. ash, 10 per cent. volatile substances, 201 pints of oil, 22 lb. of sulphate of ammonia, and 110 lb. of iron pyrites.

Fire broke out on Wednesday at the premises of the ERITH OIL CO., LTD., in a large building of one floor, 500 ft. by 150 ft., constructed of ferro-concrete, and used as a copra store. The firemen had to use smoke helmets to enable them to deal with the outbreak, which involved about 2,000 tons of copra.

LORD LEVERHULME, it is stated, has purchased De Keyser's Hotel at the City end of Blackfriars Bridge, with the intention of concentrating there the various London departments of Lever Brothers, Ltd., now housed in scattered offices. The firm hope to enter into occupation of these premises in November.

According to Reuter, arrangements have been completed by which American consumers of dyestuffs may purchase supplies from the stocks of German products set apart under the Versailles Treaty as part of the reparation to the Allies. The Textile Alliance, Inc., a non-profit making organisation, created by dye consumers, will be the medium of distribution.

A large motor lorry belonging to SAVAGE & CO., manufacturing chemists, Bradford, which was laden with six glass carboys of vitriol, on Wednesday ran down a steep decline leading to the centre of Bradford, owing, it is said, to the brakes failing to act. The vehicle collided with a tram standard, breaking the carboys. Vitriol was scattered over a wide area, causing injuries by burns to several persons.

The death took place at Crewe on Monday of Dr. F. C. TIPLER, chief chemist to the London & North-Western Railway Co., a position which he had held for many years. He was known all over the railway system from London to Carlisle, and had conducted many experiments of a highly scientific nature.

The Gallant Conduct Award of the British Industrial "Safety First" Association is to be presented to J. H. Tebbs, a worker at Brotherton's Ammonia Distillery at Leeds, for his plucky rescue of a fellow-workman, who, while repairing the top of an unright boiler, used as a decomposer, was badly gassed and lost consciousness, falling face forward on to the top of the boiler. Tebbs climbed the ladder which the unconscious man had been using and got over his recumbent body. This was an extremely risky proceeding, as the top of the boiler was only 5 ft. in diameter. Tebbs lifted the man's head away from the gas, tied a rope round his body, and lowered him to the ground.

According to the agreement made between the Commonwealth Government and the ANGLO-PERSIAN OIL CO., assented to on May 29, the latter have arranged to erect a refinery in Australia, and to supply the Commonwealth with 200,000 tons of crude oil per annum at current rates until such time as oil is found in Australia or other territories of the Commonwealth. This quantity of crude oil is estimated to yield per annum 40,000 tons of benzine, 33,300 tons of kerosene, 9,045 tons of lubricating oil, 72,000 tons of fuel oil, 4,500 tons of wax, and 9,000 tons of pitch. These commodities, other than fuel oils, will be sufficient to supply about one-half of the total requirements of Australia.

Mr. L. N. BARKER, Comptroller-General of the Department of Overseas Trade, announces that H.M. Consul at Portland, Oregon (Mr. J. P. Trant), reports that, in view of the present rat epidemic at Oregon and elsewhere in the United States, there is a great opportunity for the introduction of an effective virus of British manufacture, which would probably be welcomed if delivery is prompt and results are satisfactory. Those interested should communicate with H.M. Consul at Oregon, preferably forwarding samples for experimental purposes, and should also notify the Comptroller-General of the Department of Overseas Trade.

During the Zeppelin raid under Commander Stelling on September 8, 1915, the SKINNINGROVE IRONWORKS had a narrow escape. The benzol plant at these works had been erected in a great part by German contractors, and there is little doubt that the Germans knew all about their topography. Stelling dropped nine high-explosive and 12 incendiary bombs on the works, but the only damage done was the breaking of the water main and the electric cables, and the burning of a couple of trucks, and there was not a single casualty. An incendiary bomb fell on the concrete top of the benzol house, and a high-explosive, which dropped within 10ft. of the house, did not injure it.

THE UNITED DRUG COMPANY OF AMERICA states in its report for the half year ended June, that, through its ownership of the Class "B" common stock of Lidgett's International, Ltd., it is entitled to a proportion of the net earnings of Boots Pure Drug Co.'s ordinary shares since the 31st March last. As, however, Boots' ordinary shares did not actually pass until after June 30, such earnings are not included in the present accounts. The net profit shown, after payment of taxes, is $2,587,595. After providing for dividend on the first and second preferred stocks, calling for $600,172, there remained $1,987,442 applicable to the common stock. This is equivalent to $6.82 per share on $29,098,700 ($100 par value) common stock outstanding.

On Saturday, September 18, Sir Ernest Rutherford, Cavendish Professor of Experimental Physics, University of Cambridge, lectured before a representative audience in the Hall of Festivities of Copenhagen University on "THE COUNTING OF ATOMS." He will later give lectures on "The Structure of Atoms" and "Isotropes and their Meaning."

In furtherance of the work of re-establishing the glass industry of this country, a wide programme for the coming season has been arranged by the technical education committee of the POTTERY AND GLASS TRADES BENEVOLENT INSTITUTION. Courses of evening study will be held at the Royal Society of Arts and at the offices of the Institution, when lectures will be given by experts on such subjects as the lamp blown glass trade, works organisation, salesmanship and various forms of glass decoration.

The GERMAN POTASH SYNDICATE, in its report for 1919, states that the sales amounted to about fifty million double hundredweights. The increase which these figures show is ascribed to the resumption of business relations with former enemy countries, especially England and the United States. The United States received 701,000 double hundredweights. In 1913 they imported 2½ million double hundredweights from Germany.

The death took place on Wednesday at his residence, The Hermitage, Chester-le-Street, North Durham, of SIR LINDSAY WOOD, Bart. Sir Lindsay, who was in his 87th year, succeeded his father in the management and control of the Hetton Collieries. He took an active personal part in the development of the coal-mining industry, and himself conducted a series of elaborate and exhaustive experiments with regard to the pressure of gas in coal. He served on the Royal Commission on Accidents in Mines, and presided over the Durham Coal-owners' Association for over forty years and the Institute of Mining Engineers from 1875 to 1878.

Mr. J. D. Dry, M.Sc., Lecturer on Physics, University of Bristol, has been appointed by the board of management of the Research Association of the British Rubber and Tyre Manufacturers as a member of its scientific staff, and has already taken up his duties.

Resignation of Mr. W. S. Curphey

WE understand that Mr. W. S. Curphey has resigned the position of Chief Inspector under the Alkali Acts, which he has held for the past ten years. Mr. Curphey was responsible for the comprehensive Alkali Reports which annually grew in importance during his tenure of office, and many will regret his decision to retire.

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Abstracts of Complete Specifications

149,707. Rock Salt Brine, or Solutions of Rock Salt in Water, Removal of Calcium and Magnesium from. F. A. Freeth, Heyesmere, Sandiway, Cheshire, and L. A. Munro, Winnington Hall, Northwich, Cheshire. Application date, February 15, 1919.

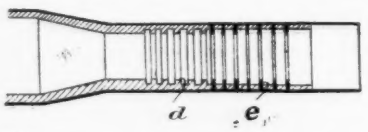
When brine is treated with a mixture of sodium carbonate and lime in such quantities that the sodium carbonate is equivalent to the calcium and the lime is equivalent to the magnesium in the brine, these impurities are precipitated, but in a form which is very bulky and difficult to filter. It is now found that if the brine is maintained at 25°C. and gently stirred while adding the re-agents and for a total period of about half an hour, the resulting precipitate is of small bulk, settles readily, and is easily filtered. A very slight excess of the re-agents must be used.

149,733. Retorts and the Like. Merz & McLellan, 32, Victoria Street, London, S.W. 1, A. C. Michie, 77, Rosebery Crescent, Jesmond, Newcastle-on-Tyne, and E. G. Weeks, 1, Tynedale Avenue, Monkseaton, Northumberland. Application date, May 14, 1919.

When fuel is being distilled in a retort at a low temperature, dust is liable to be created when fresh fuel is dropped from a hopper into the retort, and the dust is carried through to the condensers and by-product plant. The object is to avoid this contamination with dust. The fuel passes through a preheating chamber on a conveyor and is fed on to one or more horizontal conduits which enter laterally through the sides of the retort at a level slightly below the normal surface of the fuel. Each conduit is open at the top within the retort, and contains a helical conveyor so that the fuel overflows the sides of the conduit into the retort without disturbance and creation of dust.

149,748. Fats and Oils, Process for Splitting—in the Manufacture of Glycerine and Fatty Acids. W. J. Mellersh-Jackson, London. (From the Twitchell Process Co., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A.) Application date, May 15, 1919.

Relatively low grades of fats and oils are mixed with water, heated and agitated. 1 per cent. of sulphuric acid of 60° Bè. and 1 to 2 per cent. of sulphonic acids are added and the mixture agitated and heated until the glycerine and fatty acids are separated. The aqueous glycerine solution is neutralized and the constituents of the treatment acids separated by precipitation. The sulphonic acids employed are extracted by water from a sludge resulting from the sulphonation of mineral oil, preferably by the method described in 143,682. (*See* The Chemical Age, Vol. III., page 16.) These acids have a high coefficient of splitting.



149,764

149,764. Cement and the Like, Rotary Kilns for Burning. J. S. Fasting, Monradsalle, 9, Valby, near Copenhagen. International Convention date (Denmark), June 14, 1918.

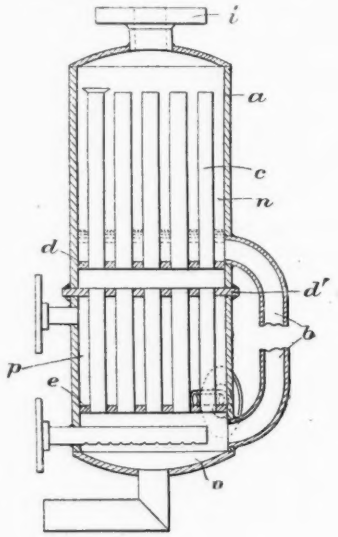
A horizontal rotary kiln for burning cement by direct contact of hot gas passed through it is provided with internal circumferential ribs, *d*, *e*, preferably of cast iron, which absorb heat from the hot gas during their rotation and transmit it to the cement by conduction. The material passes through from right to left.

149,769. Alumina, Manufacture of. J. Morel, 1, rue Moliere, Grenoble, (Isere) France. Application date, May 17, 1919.

Bauxite containing iron is heated in a Hargreaves furnace to a temperature below 800°C., and a current of steam, air and sulphur dioxide is passed over it. The mass is leached with hot water, and the solution containing aluminium and iron sulphates is filtered off. This solution is heated to boiling point and treated with sodium thiosulphate, which precipitates alumina and sulphur, liberating sulphur dioxide and leaving the iron in solution. The mixture of alumina and sulphur is washed, dried, and calcined, yielding pure alumina. The sulphur dioxide formed is used to regenerate the sodium thiosulphate by separating the sodium sulphate solution, reducing it to sulphide with carbon, and treating the sulphide in solution with the sulphur dioxide and air.

149,773. Carbonising Wood and Other Carbonaceous Material, Process and Apparatus for. J. F. Wells, 36, Sharia Falaki, Cairo. Application date, March 19, 1919.

Wood, peat, vegetable, coal, lignite or the like is charged into a vertical combustion chamber and air is admitted through the grate to burn the volatile products at the bottom of the chamber. The carbonised material is withdrawn at the bottom just at the completion of the combustion of the volatile products, and the charge moves downwards. The lighter constituents of the upper part of the charge are driven off by the combustion products from below, and are withdrawn through a jacket surrounding the combustion chamber.



149,776

149,776. Distilling and Fractionating Liquids, Apparatus for. J. Y. Johnson, Glasgow. (From H. L. Allan, Burmah Oil Co., Ltd. (Scotland), Rangoon, Burmah.) Application date, May 20, 1919.

The fractionating apparatus consists of a series of cast iron vessels such as *a*, each having a series of vertical tubes *c* carried by horizontal tube plates *d*, *d'*, *e*, as shown. The vessels *a* are connected in cascade by pipes *b*, so that the lower part of each chamber *n* communicates with the chamber *o* of the next vessel. The liquid to be fractionated passes up through and overflows from the upper tubes *c* and then through the pipes *b*. The vapour passes upwards through air condensing pipes attached to the unions *i* and connected to the top of the next vessel. Additional heat may be supplied by passing superheated steam through the space *p*.

140,783. Aluminium Nitrate, Preparation of. J. J. Hood, 4, Canonbury Park North, Islington, London, N. Application date, May 20, 1919.

Nitrolime or pure calcium nitrate is dissolved in water and aluminium sulphate is added, giving a precipitate of calcium sulphate, and a solution of aluminium nitrate which is filtered off and may be concentrated. Alternatively, ammonium or potassium nitrate may be added to aluminium sulphate and the ammonia or potash alum crystallised out, leaving aluminium nitrate in solution.

149,893. MUFFLE FURNACES, ELECTRIC. J. R. C. August, Thorn Tree Works, King's Cross, Halifax, Yorks. Application date, October 18, 1919.

The furnace is of the rotating barrel type formed by a rotating chamber closed at one end and having a muffle or barrel inserted at the other end. An annular space is left between the chamber and muffle and contains an insulated electric heater. A removable container is inserted closed end first into the muffle, and its open end is left projecting so that it may be closed by a detachable cover. The space between the muffle and the outer chamber may be divided by an intermediate cylinder, the inner space containing electric resistance material and the outer space insulating material.

Note.—No. 127,814 (Nordiske Fabriker De-No-Fa Aktieselskap), which is now accepted, was abstracted when it became open to inspection under the International Convention; it relates to polymerisation of unsaturated fatty acids. (*See* THE CHEMICAL AGE, Vol. I, page 257.)

International Specifications Not yet Accepted

146,259. FERTILISERS. Akt.-Ges. fur Anilin-Fabrikation, Treptow, Berlin. International Convention date, January 29, 1918.

A hot strong solution of ammonium nitrate is mixed with an inorganic salt, such as potassium chloride, sylvine, sylvinite, or carnallite, which has been heated to 300°C. In the resulting reaction the water evaporates and the product is then ground.

146,287. DESTRUCTIVE DISTILLATION OF COAL. F. Fischer, 2, Kaiser Wilhelm Platz, Ruhr, Mulheim, Germany. International Convention date, November 13, 1916.

Coal is distilled for the recovery of oil in a rotating retort containing a heavy iron roller of the same length, steam being admitted under reduced pressure.

146,289. ACYL CYANAMIDES. Farbenfabriken vorm. F. Bayer & Co., Leverkusen, near Cologne, Germany. (Assignees of Kalle & Co., Akt.-Ges., Biebrich-on-Rhine, Germany.) International Convention date, Nov. 22, 1915.

Halides of α-halogenfatty acids are treated with metal cyanamides such as sodium, calcium, silver, copper, or lead, in solution or suspension, to produce cyanamides of α-halogenfatty acids. The production of diethylbromacetyl cyanamide and α-bromisovaleryl cyanamide are described.

146,332. ETHYLENE, SEPARATING FROM DISTILLATION GASES. T. Goldschmidt Akt.-Ges., 18, Salkenbergsweg, Ruhr, Essen, Germany. (Assignees of F. Bergius and P. Kalnin, Ruhr, Essen, Germany.) International Convention date, October 26, 1917.

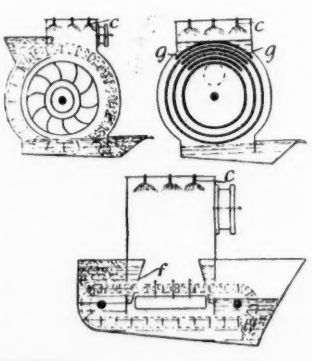
The gas is treated to remove tar, ammonia, and benzene, and then passed over absorbent carbon to remove its constituents selectively. A number of absorbent masses at different temperatures between 0°C. and 20°C. are used, and the fraction which is enriched with ethylene is expelled from the carbon and treated again.

146,333. SODIUM HYDRATE AND HYDROCHLORIC ACID. C. Bonneau, 207, Corretera del Clot, Barcelona, and J. M. Aragay, 84, Geroma, Barcelona. International Convention date, January 30, 1919.

When a mixture of fused sodium chloride and platinised asbestos is treated with superheated steam, sodium hydrate and hydrochloric acid are obtained.

146,356. WASHING GASES AND VAPOURS. W. Freytag, 5, Alexanderstrasse, Dortmund, Germany. International Convention date, August 19, 1918.

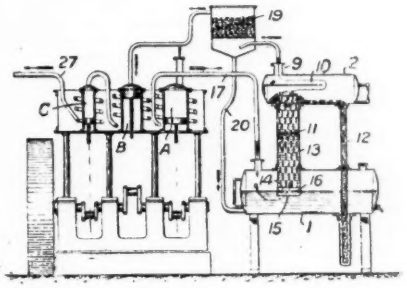
Liquid such as tar oil or water is sprayed by devices *c* on to a travelling band having pockets filled with material such as peat or lignite. The filtering material is supplied and discharged continuously, and may be burnt or vaporised after use. In Fig. 2 the gas is supplied to the centre of a rotary filter, and in Fig. 4 segments of fine meshed netting, *g*, are used for filtering, and the gas is forced through by concentric rotating rings.



146,356

146,396. CONCENTRATING ORES. E. Otsuka, 66, Toyooka Machi, Mita, Shiba Ku, Tokyo. International Convention date, December 30, 1917.

In froth-flotation apparatus, the ore pulp is fed through a preliminary chamber, where it is mixed and agitated with two or more frothing agents and air. The ore then passes to the main chamber, where it is agitated with water and air, the rotating agitators having spirally arranged projections. The mixture then passes through a perforated partition to a separating chamber.



146,397

146,397. WASHING GASES. Soc. l'Oxylithe, 225, Quai Aulagnier, Asnieres, Seine, France. International Convention date, January 22, 1919.

Compressed gas containing carbon dioxide passes from a cylinder, *A*, through a pipe, 17, to a vessel, 1, containing alkali, which is displaced upwards through a wide tube, 11, containing earthenware blocks and perforated at the bottom. When the perforations are uncovered the gas passes upwards through the tube 11, and the carbon dioxide is absorbed, the purified gas passing to a drier, 19, containing solid caustic alkali, and thence to compressing cylinders *B*, *C*. Liquid carried upwards into the chamber 2 returns to the chamber 1 by the pipe 12, as well as any liquid from the drier by the pipe 20.

146,398. SULPHATES, CHLORIDES AND CARBONATES. R. D. Lance, 10, Rue de la Repiniere, Paris. International Convention date, May 16, 1916.

Pyritic ores are heated under pressure with sulphuric or hydrochloric acid and "chloro-nitrous products," and the product leached with water or sulphuric or hydrochloric acid, and an alkaline earth chloride if necessary to obtain chlorides. Alkali, alkaline earth or ammonium carbonates are added to precipitate the metals, which are separated and calcined. If magnesium carbonate is used, the residual magnesium chloride is calcined to obtain hydrochloric acid.

146,407. HYDROGENATING FATS AND FATTY ACIDS. G. Teichner, 3, Anton-Frankgasse, Vienna. (Assignee of H. Berger, 153, Wahringerstrasse, Vienna.) International Convention date, November 10, 1916.

The object is to obtain a nickel catalyst for hydrogenation. Nickel sulphate solution is treated with sodium bicarbonate, and the precipitated nickel carbonate is washed, dried and reduced with hydrogen at 220°C. for two hours. Alternatively, nickel hydroxide may be precipitated by ammonia. The carbonate or hydroxide is thus obtained in the form of fine non-coherent particles, and the reduction leaves the interior of the particles unaffected. This material is used as the catalyst.

146,410. ZINC SULPHIDE AND LITHOPONE. C. Clerc, 29, Rue d'Astorg, Paris, and A. Nihoul, 6, Avenue Caroline Therese, Villeneuve le Roi, France. International Convention date, May 20, 1919.

Zinc chloride obtained by the action of hydrochloric acid on zinc blende is purified, and oxide or carbonate of the alkali or alkaline earth metals is added in such quantity that after precipitation of zinc sulphide with sulphuretted hydrogen, the final solution remains slightly acid. If magnesium oxide or carbonate is used, hydrochloric acid and magnesia may be regenerated by adding magnesia to the magnesium chloride solution, and treating the resulting oxychloride with steam. The zinc sulphide is calcined and mixed with barium sulphate,

146,411. FUMARIC ACID. C. Wehmer, 35, Alleestrasse, Hanover, Germany. International Convention date, September 28, 1915.

Cane sugar, dextrose, maltose, &c., is fermented by a mould, termed *Aspergillus fumaricus*, a description of which is given, in the presence of chalk. The calcium fumarate is then treated with sulphuric acid.

146,427. TANNING AGENTS, SYNTHETIC. Badische Anilin & Soda-Fabrik, Ludwigshafen-on-Rhine, Germany. International Convention date, February 19, 1919.

Crude anthracene or carbazole, or anthracene waste, is sulphonated and the product decolorised by chlorine, hypochlorites, oxalic acid or formaldehyde. The products give a light-coloured leather.

146,455. SACCHARIFYING CELLULOSE. A. Wohl, 113, Hauptstrasse, Langfuhr, Dantzig, Germany. International Convention date, March 14, 1917.

Materials containing cellulose are treated with strong hydrochloric or sulphuric acid, and the soluble carbohydrates are obtained by lixiviation in a counter-current. These carbohydrates are separated from the acids by a diffusion process, sufficient acid being retained to complete the subsequent hydrolysis.

146,456. FILTERS. J. Herbing, 3, Geseviusstrasse, Halle-on-Saale, Germany. International Convention date, July 3, 1919.

The filter is for recovering dust from dust-laden gas. It consists of threads of wool, mineral wool, asbestos, or hemp suspended from a wire network, and of such a length that when the gas is passed upwards through the filter the threads assume an inclined position.

146,472. CRACKING HYDROCARBONS. Standard Oil Co., 26, Broadway, New York. (Assignees of H. P. Chamberlain, 570, Ellicott Avenue, Buffalo, N.Y., U.S.A.) International Convention date, October 20, 1913.

A mixture of petroleum hydrocarbons—*e.g.*, the heavy paraffin distillate produced by distilling crude petroleum—is distilled at a pressure of 30-75 lb. per square inch to obtain naphtha, burning oil and asphalt. The distillate is fractionated and the heavier oils mixed with fresh material. The asphaltic residue may be freed from volatile constituents and may be oxidised by treatment with air. The cracking is effected in a still which is heated at the bottom, insulated at the middle and cooled at the top, and the rate is such that the distillate amounts to 2 per cent. of the charge per hour.

146,498. RESINS, SYNTHETIC. Badische Anilin & Soda-Fabrik, Ludwigshafen-on-Rhine, Germany. International Convention date, June 13, 1919.

Cyclohexanone is heated under pressure with methyl-alcoholic potash or solid caustic potash, or boiled with methyl-alcoholic soda. Alternatively, *p*-methylcyclohexanone or cyclohexylidenecyclohexanone may be used. The products may be used for making varnishes or lacquers, and are soluble in alcohol, linseed oil, &c.

Specifications Accepted, with Date of Application

7,186/1914. Oxide or roasted sulphide tin ores, Process for the removal of iron from—by treatment with acids. Chiapponi, Hesse and von Rauschenplat. March 28, 1913.

108,494. Saccharic acid and tartaric acid from carbohydrates, Production of. Diamalt Akt.-Ges. August 4, 1916.

116,503. Endothermic gas reactions, Furnace for carrying out. Elektro-chemische Werke Ges. March 23, 1917. Addition to 5,281/1911.

125,380. Evaporating, cooling, concentrating, washing and other purposes, Method of and means for effecting intimate contact between liquids and gases for. H. E. La Bour. April 8, 1918.

132,490. Hydrocarbon liquids from carbonaceous material, method for the production of. F. P. A. Rousseau. September 9, 1918.

129,978. Intensifying the mutual action one on the other during mixing of gases with liquids or solids. Soc. Anon. L'Oxhydrique Francaise. July 19, 1918.

136,151. Zinc, recovery of, by electrolysis. Electrolytic Zinc Co. December 3, 1918.

137,519. Potassium sulphate, manufacture of. Fabriques de Produits Chimiques de Thann et de Mulhouse. December 30, 1918.

138,600. Nickel and copper, manufacture of. International Nickel Co. February 5, 1919.

150,360. Acetone and butyl alcohol, Fermentation processes for the production of. C. Weizmann. May 25, 1917.

150,401. Allyl ester of 2-phenyl-quinoline-4-carboxylic acid. O. Imray. (*Soc. of Chemical Industry.*) May 28, 1919.

150,412. Aromatic nitro compounds, process for reducing. J. Tcherniac and S. H. Davies. May 29, 1919.

150,482. Tunnel ovens or kilns. C. Whitfield. July 2, 1919.

150,485. Filters. A. Ford. July 3, 1919.

150,589. Vertical retorts or ovens, introduction of steam into. Woodall, Duckham and Jones (in liquidation), and Sir A. M. Duckham. December 18, 1919.

150,595. Electrolytic cells. W. J. Mellersh-Jackson. (*Allen Electrolytic Cell Corporation.*) January 5, 1920.

LATEST NOTIFICATIONS.

150,983. Coke ovens. American Coke & Chemical Co. September 8, 1919.

150,989. Dyeing of cellulose, acetate, artificial silk, films and the like. Soc. Chimique des Usines du Rhone. September 5, 1919.

150,991. Hydrogenation apparatus. Dayton Metal Products Co. October 5, 1918.

150,725. Means for closing glass bottles for chloride of ethyl and other volatile products. Bengue, J. September 3, 1919.

150,734. Acid chambers, acid towers, acid mains and similar arrangements. Pfannenschmidt, P. L. September 8, 1919.

150,744. Direct synthesis of ammonia. L'Air Liquide Soc. Anon. September 8, 1919.

150,962. Alkali sulphate and hydrochloric acid. Goldschmidt Akt.-Ges., T. September 9, 1919.

150,968. Yeast. Jensen, A. J. September 12, 1919.

150,979. Manufacture of nitro-calcite nitrogenous calcium, capable of being sprinkled and stored. September 12, 1919.

Applications for Patents

Akt.-Ges. für Stickstoffdünger. Manufacture of nitro-calcite nitrogenous calcium capable of being sprinkled and stored. 26,269. September 13. (Germany, September 12, 1919.)

American Coke & Chemical Co. Coke ovens, &c. 26,657. September 17. (United States, October 3, 1919.)

Amiot, J. Photographic sensitisers. 26,395. September 14. (France, September 15, 1919.)

Atack, F. W. Process of oxidising hydrocarbons. 26,698. September 18.

Bacon, G. C. (*Oldbury Electro Chemical Co.*) Manufacture of alkali formates. 26,661. September 17.

,, Manufacture of formates of the alkali metals. 26,662. September 17.

,, Manufacture of oxalates of the alkali metals. 26,663. September 17.

Boulton & Paul. Devices for raising liquids. 26,524. September 16.

Denington, R. C. Converting cellulosic and ligneous material into sugars. 26,542. September 16.

Dreyfus, H. Manufacture or treatment of products made with cellulose derivatives. 26,733. September 18.

Pfiske, G. E. Devices for raising liquids. 26,524. September 16.

George, R. D. Decomposing heavy hydrocarbon oils into lighter oils. 26,340. September 14. (United States, September 30, 1919.)

Gish, D. B. Treating hydrocarbons for explosive engines. 26,405. September 15.

Hargreave, G. Apparatus for drying, concentrating and filming solids, liquids, &c. 26,214. September 13.

Hutchins, T. W. S. Apparatus for destructive distillation of carbonaceous materials. 26,448. September 15.

John, H. Manufacture of condensation products of formaldehyde and carbamide or carbamide derivatives. 26,381. September 14. (Austria, May 16, 1918.)

Lavandeyra, A. de. Aluminium alloys and method of making same. 26,508. September 16.

Lunden, H. L. R. and Thorssill, C. T. Production of ammonia from cyanides. 26,677. September 17. (Sweden, October 6, 1919.)

,, Saving heat in the production of ammonia from cyanides or cyanamides. 26,678. September 17. (Sweden, October 6, 1919.)

McKean, J. G. Liquid-fuel apparatus. 26,197. September 13.

,, Liquid-fuel furnaces. 26,395. September 15.

Licences of Right

The following patents were endorsed "Licences of Right" on September 15, 1920, by virtue of the provisions of Sect. 24 of the Patent and Designs Acts (1907-1919):—19,604—12 (Charge mixture for producing hydrochloric acid and alkali-silico-aluminate); 19,605—1912 (Process for making hydrochloric acid and alkali-silico-aluminate); 107,640 (Treatment of silicates). All are in the name of A. H. Cowles. This endorsement of the patents facilitates the securing of licences by persons desirous of using these processes.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

THURSDAY, September 23.

We regret that we find ourselves unable to report any improvement in the conditions to which we referred last week. The general depression in trade unfortunately continues, being, of course, largely influenced by the prospective labour troubles.

The home trade is particularly quiet and generally speaking there is little of interest.

A good export enquiry for certain lines is again reported.

General Chemicals

ACETONE.—A satisfactory business has been done during the past week at full prices.

ACID ACETIC.—The price remains firm for spot delivery, and the article passes steadily into consumption.

ACID CARBOLIC is still a weak and featureless market.

ACID CITRIC.—Only a nominal business is reported without change in price.

ACID FORMIC is in much better demand. Prices firm, but unchanged.

ACID OXALIC is quietly steady in tone.

ACID TARTARIC.—The tone remains easy, but rather a better volume of business is reported.

BLEACHING POWDER remains in good export enquiry, and is difficult to obtain for early delivery.

COPPER SULPHATE remains a lifeless market.

FORMALDEHYDE is still easy in tone, but when certain existing stocks are reduced, an improvement is not unlikely.

LEAD SALTS remain particularly quiet, and little business is visible.

POTASSIUM PRUSSIATE is firm in tone. Very little business is reported.

SODA CAUSTIC.—There is perhaps a slightly better tendency, but only a limited business is passing.

SODA BICHROMATE.—Parcels continue to appear in second-hands, and with a limited demand the position is easy.

SODA NITRITE remains a small business, but the price is maintained.

SODA PHOSPHATE.—Unchanged.

SODA PRUSSIATE.—There is a certain enquiry for export, makers adhering to the level of prices recently indicated.

ZINC SALTS remain featureless.

Coal Tar Intermediates

There is very little change to report in this section, and only a small volume of business has been passing. Prices, however, still hold firm, and in the majority of cases makers are still behind in deliveries.

ALPHA NAPHTHYLAMINE.—This article has been in fair demand.

ALPHA NAPHTHOL has been asked for on export account.

BETA NAPHTHOL.—Rather more material is being offered, but prices are firm.

DIMETHYLANILENE.—A small business has been passing in this article.

PARANITRANILINE is without change.

PARAPHENYLENE DIAMINE has been in demand, and price is well maintained.

RESORCIN is still scarce.

Coal Tar Products

There is little change in the market to report.

90's BENZOL is still scarce, and quoted 3s. 10d. to 3s. 11d. in the North, and 4s. to 4s. 1d. in the South.

PURE BENZOL is worth 4s. 3d. per gallon.

CREOSOTE OIL remains unchanged at 1s. 1d. to 1s. 1½d. in the North, and 1s. 2d. to 1s. 2½d. in the South.

CRESYLIC ACID is slightly more active, although prices remain unchanged at 4s. to 4s. 2d. per gallon for the dark 95/97 per cent. quality, and 4s. 7d. to 4s. 10d. per gallon for the pale 97/99 per cent. quality.

SOLVENT NAPHTHA is slightly firmer, and is quoted at 3s. 2d. on rails.

HEAVY NAPHTHA remains unchanged at 3s. 6d. per gallon.

NAPHTHALENE.—The crude qualities are scarce and in good demand, and prices which still have an upward tendency are £16 to £25 per ton. Refined is not quite so active, although the prices remain in the region of £50 to £55 per ton.

PITCH.—The market remains firm, and buyers abroad are showing more interest. London is still quoted at 220s. to 225s. f.o.b., and East Coast is quoted 215s. to 217s. 6d. per ton f.o.b.

Sulphate of Ammonia

The demand for Home trade is satisfactory, and a fair tonnage is now being exported.

Current Prices

Chemicals

	per	£	s	d.		£	s	d.
Acetic anhydride	lb.	0	3	9	to	0	4	0
Acetone oil	ton	90	0	0	to	95	0	0
Acetone, pure	ton	120	0	0	to	125	0	0
Acid, Acetic, glacial, 99-100%	ton	105	0	0	to	110	0	0
Acetic, 80% pure	ton	85	10	0	to	87	10	0
Arsenic	ton	100	0	0	to	105	0	0
Boric, cryst.	ton	74	10	0	to	76	0	0
Carbolic, cryst. 39-40%	lb.	0	1	0½	to	0	1	1
Citric	lb.	0	4	6	to	0	4	9
Fluoric	lb.	0	0	7½	to	0	0	8
Formic, 80%	ton	115	0	0	to	120	0	0
Gallic, pure	lb.		7	6	to	0	7	9
Hydrofluoric	lb.	0	0	7½	to	0	0	8
Lactic, 50 vol.	ton	58	0	0	to	60	0	0
Lactic, 60 vol.	ton	72	10	0	to	75	0	0
Nitric, 80 Tw.	ton	41	0	0	to	44	0	0
Oxalic	lb.	0	2	4	to	0	2	5
Phosphoric, 1.5	ton	65	0	0	to	67	0	0
Pyrogallic, cryst	lb.	0	11	6	to	0	11	9
Salicylic, Technical	lb.	0	2	3	to	0	2	6
Salicylic, B.P.	lb.	0	3	1	to	0	3	2
Sulphuric, 92-93%	ton	8	10	0	to	8	15	0
Tannic, commercial	lb.	0	3	6	to	0	3	9
Tartaric	lb.	0	3	1	to	0	3	2
Alum, lump	ton	19	10	0	to	20	0	0
Alum, chrome	ton	92	0	0	to	93	0	0
Alumino ferric	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%	ton	17	10	0	to	18	10	0
Aluminium, sulphate, 17-18%	ton	20	10	0	to	21	10	0
Ammonia, anhydrous	lb.	0	2	2	to	0	2	4
Ammonia, .880	ton	43	0	0	to	45	0	0
Ammonia, .920	ton	30	0	0	to	32	10	0
Ammonia, carbonate	lb.	0	0	7½	to	—		
Ammonia, chloride	ton	95	0	0	to	100	0	0
Ammonia, muriate (galvanisers)	ton	60	0	0	to	65	0	0
Ammonia, nitrate	ton	65	0	0	to	70	0	0
Ammonia, phosphate	ton	120	0	0	to	125	0	0
Ammonia, sulphocyanide	lb.	0	3	0	to	0	3	3
Amyl acetate	ton	420	0	0	to	425	0	0
Arsenic, white, powdered	ton	75	0	0	to	77	0	0
Barium, carbonate, 92-94%	ton	12	10	0	to	13	0	0
Barium, chlorate	lb.	0	0	11	to	0	1	0
Chloride	ton	32	0	0	to	33	0	0
Nitrate	ton	55	0	0	to	56	0	0
Barium Sulphate, blanc fixe, dry	ton	28	10	0	to	30	0	0
Sulphate, blanc fixe, pulp	ton	16	10	0	to	17	0	0
Sulphocyanide, 95%	lb.	0	1	6	to	0	1	8
Bleaching powder, 35-37%	ton	28	0	0	to	29	0	0
Borax crystals	ton	41	0	0	to	42	10	0
Calcium acetate, Brown	ton	20	0	0	to	21	0	0
,, Grey	ton	34	0	0	to	35	10	0
Calcium Carbide	ton	30	0	0	to	32	0	0
Chloride	ton	9	10	0	to	10	10	0

	per	£	s.	d.		£	s.	d.
Carbon bisulphide	ton	65	0	0	to	67	0	0
Casein, technical	ton	75	0	0	to	80	0	0
Cerium oxalate	lb.	0	3	9	to	0	4	0
Chromium acetate	lb.	0	1	2	to	0	1	4
Cobalt acetate	lb.	0	8	6	to	0	9	0
Oxide, black	lb.	0	10	0	to	0	10	3
Copper chloride	lb.	0	1	3	to	0	1	6
Sulphate	ton	41	0	0	to	42	0	0
Cream Tartar, 98-100%	ton	245	0	0	to	250	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde 40% vol.	ton	315	0	0	to	320	0	0
Formusol (Rongalite)	lb.	0	5	0	to	0	5	6
Glauber salts	ton	Nominal.						
Glycerine, crude	ton	70	0	0	to	72	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	9	to	0	2	10
Iron perchloride	ton	50	0	0	to	52	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	85	0	0	to	87	10	0
Carbonate (White Lead)	ton	65	0	0	to	67	10	0
Nitrate	ton	55	0	0	to	57	0	0
Litharge	ton	57	0	0	to	59	0	0
Lithopone, 30%	ton	50	0	0	to	51	0	0
Magnesium chloride	ton	15	10	0	to	16	10	0
Carbonate, light	cwt	2	15	0	to	3	0	0
Sulphate (Epsom salts commercial)	ton	13	10	0	to	14	0	0
Sulphate (Druggists')	ton	18	10	0	to	19	10	0
Manganese, Borate	ton	190	0	0	to	—		
Sulphate	ton	100	0	0	to	105	0	0
Methyl acetone	ton	95	0	0	to	100	0	0
Alcohol, 1% acetone	gall.	Nominal.						
Nickel sulphate, single salt	ton	60	0	0	to	62	0	0
Nickel ammonium sulphate, double salt	ton	62	0	0	to	64	0	0
Potassium bichromate	lb.	0	1	10½	to	0	1	11
Carbonate, 90%	ton	115	0	0	to	120	0	0
Chloride	ton	50	0	0	to	52	0	0
Chlorate	lb.	0	0	9½	to	0	0	10½
Meta bisulphite, 50-52%	ton	260	0	0	to	270	0	0
Nitrate, refined	ton	65	0	0	to	67	0	0
Permanganate	lb.	0	4	0	to	0	4	3
Prussiate, red	lb.	0	4	3	to	0	4	6
Prussiate, yellow	lb.	0	2	0	to	0	2	1
Sulphate, 90%	ton	31	0	0	to	33	0	0
Salammoniac, firsts	cwt.	5	10	0	to		—	
Seconds	cwt.	5	5	0	to		—	
Sodium acetate	ton	59	0	0	to	61	0	0
Arsenate, 45%	ton	60	0	0	to	62	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	1	4	to	0	1	5
Bisulphite, 60-62%	ton	50	0	0	to	52	10	0
Chlorate	lb.	0	0	5	to	0	0	5½
Caustic, 70%	ton	32	0	0	to	33	0	0
Caustic, 76%	ton	38	10	0	to	39	0	0
Hydrosulphite, powder, 85%	lb.	0	4	0	to	0	4	6
Hyposulphite, commercial	ton	35	10	0	to	37	10	0
Nitrite, 96-98%	ton	87	10	0	to	90	0	0
Phosphate, crystal	ton	47	0	0	to	49	0	0
Perborate	lb.	0	2	2	to	0	2	4
Prussiate	lb.	0	1	2½	to	0	1	3½
Sulphide, crystals	ton	30	0	0	to	32	0	0
Sulphide, solid, 60-62%	ton	55	0	0	to	57	0	0
Sulphite, cryst.	ton	15	10	0	to	16	10	0
Strontium carbonate	ton	85	0	0	to	90	0	0
Nitrate	ton	90	0	0	to	95	0	0
Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride	ton	42	0	0	to	44	10	0
Sulphur, Flowers	ton	19	0	0	to	19	10	0
Roll	ton	19	0	0	to	19	10	0
Tartar emetic	lb.	0	3	2	to	0	3	4
Tin perchloride, 33%	lb.	0	2	6	to	0	2	7
Perchloride, solid	lb.	0	3	0	to	0	3	3
Protochloride (tin crystals)	lb	0	2	0	to	0	2	1
Zinc chloride, 102 Tw.	ton	22	0	0	to	23	10	0
Chloride, solid, 96-98%	ton	60	0	0	to	65	0	0
Oxide, 99%	ton	82	10	0	to	85	0	0
Oxide, 94-95%	ton	70	0	0	to	72	10	0
Dust, 90%	ton	90	0	0	to	92	10	0
Sulphate	ton	21	10	0	to	23	10	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	4	0	to	0	4	3
Alphanaphthol, refined	lb.	0	5	6	to	0	5	9
Alphanaphthylamine	lb.	0	3	9	to	0	4	0
Aniline oil, drums extra	lb.	0	1	8	to	0	1	9
Aniline salts	lb.	0	1	10	to	0	2	0
Anthracene, 85-90%	lb.		—		to		—	
Benzaldehyde (free of chlorine)	lb.	0	5	9	to	0	6	0
Benzidine, base	lb.	0	13	6	to	0	14	0
Benzidine, sulphate	lb.	0	10	6	to	0	11	0
Benzoic acid	lb.	0	5	3	to	0	5	6
Benzoate of soda	lb.	0	5	3	to	0	5	6
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	5	6	to	0	5	9
Betanaphthylamine, technical	lb.	0	11	6	to	0	12	6
Croceine Acid, 100% basis	lb	0	5	0	to	0	6	3
Dichlorbenzol	lb.	0	0	6	to	0	0	7
Diethylaniline	lb.	0	7	9	to	0	8	6
Dinitrobenzol	lb.	0	1	4	to	0	1	5
Dinitrochlorbenzol	lb.	0	1	5	to	0	1	6
Dinitronaphthaline	lb.	0	1	6	to	0	1	8
Dinitrotoluol	lb.	0	1	8	to	0	1	9
Dinitrophenol	lb.	0	2	9	to	0	3	0
Dimethylaniline	lb.	0	5	9	to	0	6	0
Diphenylamine	lb.	0	5	0	to	0	5	3
H-Acid	lb.	0	14	6	to	0	15	0
Metaphenylenediamine	lb.	0	5	9	to	0	6	0
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	7	6	to	0	8	6
Monosulphonic Acid (2:7)	lb.	0	7	6	to	0	8	0
Naphthionic acid, crude	lb.	0	5	6	to	0	6	0
Naphthionate of Soda	lb.	0	6	0	to	0	6	3
Naphthylamin-di-sulphonic-acid	lb.	0	5	6	to	0	6	6
Nitronaphthaline	lb.	0	1	4	to	0	1	6
Nitrotoluol	lb.	0	1	3	to	0	1	4
Orthoamidophenol, base	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	2
Orthotoluidine	lb.	0	2	6	to	0	2	9
Orthonitrotoluol	lb.	0	1	3	to	0	1	4
Para-amidophenol, base	lb.	0	15	0	to	0	16	0
Para-amidophenol, hydrochlor	lb	0	15	6	to	0	16	6
Paradichlorbenzol	lb.	0	0	6	to	0	0	8
Paranitraniline	lb.	0	8	6	to	0	9	0
Paranitrophenol	lb.	0	2	9	to	0	3	0
Paranitrotoluol	lb.	0	5	9	to	0	6	0
Paraphenylenediamine, distilled	lb.	0	13	6	to	0	14	6
Paratoluidine	lb.	0	8	6	to	0	9	6
Phthalic anhydride	lb.	0	4	9	to	0	5	0
R. Salt, 100% basis	lb.	0	4	0	to	0	4	2
Resorcin, technical	lb.	0	11	6	to	0	12	6
Resorcin, pure	lb.	1	2	6	to	1	5	0
Salol	lb.	0	6	9	to	0	7	0
Shaeffer acid, 100% basis	lb.	0	3	6	to	0	3	0
Sulphanilic acid, crude	lb.	0	1	6	to	0	1	7
Tolidine, base	lb.	0	10	6	to	0	11	6
Tolidine, mixture	lb.	0	3	0	to	0	3	6

Alsatian Potash

LARGE supplies are being brought forward to Rotterdam and Antwerp in readiness for the autumn demand, which is expected to be brisk. The output of the mines this year has exceeded all expectations. During the past week quotations per ton f.o.r., in bags, have been approximately as follows :—French kainit, 14-16 per cent., £7 13s. 6d. ; French potash salts, 20-22 per cent., £9 13s. 6d. ; French potash salts, 30-32 per cent., £13 13s. 6d. ; muriate of potash, 50 and 60 per cent., £28 5s.

Cardiff By-Product Market

Wednesday, September 22.

Sulphate of Ammonia—	
For home consumption (per ton o.t.)	£24 d./d.
For export (per ton f.o.b.)	£30 to £40
Benzol, 90's (per gallon)	3s. 5d. to 3s. 10d.
Benzol, 50's (per gallon)	3s. 5d.
Solvent Naphtha (per gallon)	3s. to 3s. 3d.
Heavy Naphtha (per gallon)	3s. 3d. to 3s. 6d.
Crude Naphthalene Salts (per ton)	£16 to £26
Pitch (per ton)	200s. to 220s.
Creosote (per gallon)	1s. 2d. to 1s. 3d.
Motor Benzol (per gallon)	3s. 5d. to 3s. 10d.
Crude Benzol (per gallon)	3s. 3d.
Toluol (per gallon)	3s. 10d.

THE ALSACE-LORRAINE DEVELOPMENT & TRADING CO., LTD., have removed to Pinner's Hall, Old Broad Street, E.C.2. Their telephone number is now London Wall 5124 (three lines), and telegrams should be addressed to Evalsalora Stock, London.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Partnerships Dissolved

BUTTERWORTH, WILLIAM, & GREENWOOD, ALBERT, soap and candle manufacturers, Albion Works, Milnrow, Lancashire, by mutual consent as from July 31.

ATKINSON, EDMUND, 7, Cowley Road, Rodley, Yorks, and BROWN, ROBERT, 3, Cowley Road, Rodley, manufacturers and dealers in turpentine substitutes, carrying on business at Broomfield Works, Gay Lane, Otley, Yorks, under the style of Brown & Atkinson, by mutual consent as and from September 13. All debts received and paid by Robert Brown, who will carry on the business under the same style.

Company Winding Up Voluntarily

CARTHAGE OIL SYNDICATE (in voluntary liquidation).—A general meeting of members will be held at 32, Sackville Street, London, W. 1, on Friday, October 22, at 12 noon. A. H. Dwight, Liquidator.

Liquidators' Notice

LONDON & MAIKOP OIL CORPN., LTD. (in liquidation).—The annual meeting of shareholders will be held at the office of the Liquidator, Moorgate Court, Moorgate Place, London, on Thursday, September 30, at 11 a.m. A. E. Cave, Liquidator.

SCIENTIFIC GLASS CO., LTD.—A meeting of creditors will be held at the offices of Keenlyside & Forster, Lloyds Bank Chambers, Collingwood Street, Newcastle-on-Tyne, on Friday, October 1, at 3.30 p.m. T. E. Rowell, Liquidator.

New Companies Registered

The following have been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C. :—

GEIGY COLOUR COMPANY, LTD., 35 to 37, Dickenson Street, Manchester.—Manufacturers of colours, &c. Nominal capital £20,000 in 20,000 shares of £1 each. Directors: R. Geigy, S. E. Koohlin, H. P. Addleshaw. Qualification of directors, one share.

LONDON ASSOCIATED OIL CO., LTD., 30A, George Street, Hanover Square, W.1.—Refiners, manufacturers and dealers in oils, grease, fats and lubricating substances of all kinds. Nominal capital £5,000 in 5,000 shares of £1 each. Directors: J. A. Poxon, G. B. Poxon. Qualification of directors, £10. Remuneration of directors, £250 to be divided.

BLOOMSBURY GLASS WORKS, LTD., 11/13, Gilbert Street, E.C.—Glass manufacturers. Nominal capital, £2,000 in 2,000 shares of £1 each. Directors: S. Strong, T. Prior (Gov. Dir.). Qualification of directors, £100.

NATIONAL PAPER & PULP CO. (1920), LTD., 66, Upper Thames Street, E.C.—Manufacturers of paper of every description. Nominal capital, £300,000 in 300,000 ordinary shares of £1 each. Minimum subscription, 7 shares. Directors: Sir H. B. Ironside (director and chairman of Paripan, Ltd.), G. H. Wilkinson, H. D. Wilkinson, G. H. Wilkinson (jun.) D. Smith. Qualification of directors, £1,100. Remuneration of directors, £1,000 to be divided.

PAR MOOR CHINA CLAY CO., LTD., 25, Glebe Street, Stoke-on-Trent.—Manufacturers of china clay. Nominal capital, £15,000 in 15,000 shares of £1 each ordinary. Directors: P. Duxbury, A. D. S. Stocker, W. W. Wood (jun.), H. Duxbury, W. M. G. Stocker, E. B. Stocker. Qualification of directors, 500 ordinary shares.

RYLAND BARYTES AND SILICA COMPANY, LTD.—To carry on mining businesses, &c. Nominal capital £65,000 in 35,000 preference shares, and 30,000 ordinary shares of £1 each. Minimum subscription seven shares. Directors: F. H. Featherstone, G. D. Treece, F. T. Goulding, J. F. Offord, G. Trudgett, P. J. Alston, Amelia Beswick. Qualification of directors, £100. Remuneration of directors, £50 each. Chairman, £100.

SMITHS (HAMPTON), LIMITED, 1, Queen Victoria Street, E.C.—Soap and candle manufacturers. Nominal capital £50,000 in 200,000 shares of 5s. each. Directors to be appointed by subscribers. Qualification of directors, £500. Subscribers, S. W. Copley, W. Clarke.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

Locality of Firm or Agent.	Materials.	Ref. No.
British India	Glassware	363
Ottawa ...	Glassware; druggists' sundries ...	366; 391
British West Indies	Glassware; druggists' sundries ...	376
Mexico ...	Chemicals; paints	397
China	Aniline dyes; paints; glass; chemicals; oil presses.	417
Germany (Neuss-on Rhine)	Mineral, animal, vegetable oils and fats.	415

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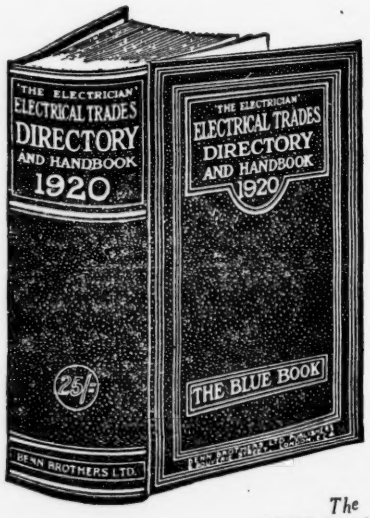

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